DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

METAL FINISHING

DECEMBER, 1949 VOLUME 47 • NUMBER 12

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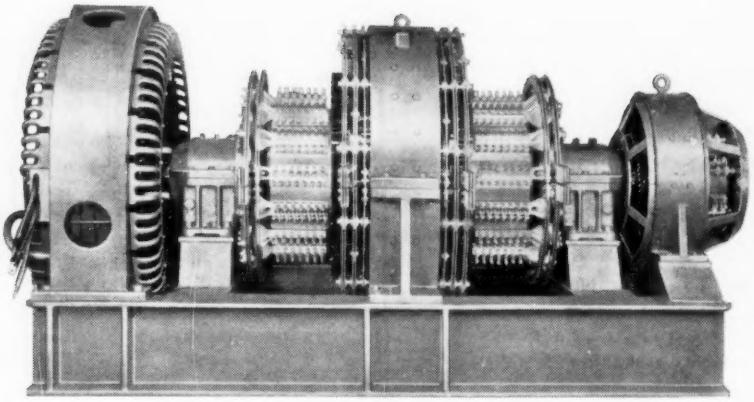

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METAL FINISHING

Peace in Industrial America

Out of the recent conference of the American Management Association came a wealth of practical information and searching analysis of present day employer-employee relations. A point of particular significance was brought out in reply to the question—"What does the employee really want from his job?"

It seems that the most sought-after conditions connected with every job are: 1) Fair wages, 2) Job and personal security, 3) Opportunity to advance by utilizing his highest skills at all times, 4) A feeling of "belonging" to the organization in *all* its operations, and 5) personal recognition of his contribution to the success of the organization when it is warranted.

If ever there is going to be real industrial peace in America, it is apparent that all *five* of the above issues must be resolved, as time has proven that high wages alone are not the final answer. Certainly the union leadership is making the most of the first two points above. A fertile field for future management activity lies in actions to promote the full realization of the remaining three points. Should management fail in its endeavors along these lines, it may in the coming years find itself forced to arbitrate more and more of these traditional "management functions" over the bargaining table. The recent discord over pensions and welfare funds was an indication of the trend in this direction.

It will be a sad day indeed if management has to admit that the only way these remaining basic issues could be resolved to mutual satisfaction was through the medium of costly and unpleasant strikes.

W. A. Raymond

EDITOR

Metal Finishing
Wishes You A Very Merry Christmas

Adhesion of Hard Nickel To High-Strength Aluminum Alloy

By B. B. Knapp, *Research Chemist, International Nickel Co.*

SOME years ago it became necessary to solve the problem of electroplating a high-strength aluminum alloy containing 7% zinc with an adherent deposit of hard nickel, to protect the alloy in an application involving severe erosion. Its solution is presented here with the hope that the methods used might be applicable to other cases of a similar nature. The paper describes first, a method of electroplating the high-strength aluminum alloy with an adherent deposit of hard nickel, and second, a new quantitative adhesion test that was developed for measuring the adhesion of nickel on aluminum sheet. It is possible that the process developed for this alloy could be used on other aluminum alloys which are difficult to electroplate with adherent deposits. The adhesion test has been found invaluable for measuring the adhesion strength of many metallic coatings on sheet material.

Development of Method

The well known zincate process[1] for electroplating aluminum alloys gives excellent adhesion on many wrought alloys. However, when it was applied to articles made from a wrought zinc-aluminum alloy (Zinc—7%, Magnesium—1%, Manganese—0.5%) the adhesion of a hard nickel[2] electrodeposit was poor. The procedure used is listed as Cycle 1, Table I. The adhesion obtained by this procedure ranged from 2,000 to 4,000 psi. It was recommended that a mixed acid pickle be inserted after step 5 (Cycle 2, Table I) and this increased the adhesion to 6,700-7,600 psi. The fractures on these adhesion specimens occurred largely at the bond and between the copper and the aluminum. Sample articles were plated by the latter procedure with a hard nickel deposit 0.005″ thick. Considerable trouble was experienced with blistering of the copper deposit. Each time this occurred the article was dipped in concentrated nitric acid to remove the copper and zinc immersion coating and then reprocessed, starting with step 2. The blistering usually decreased with each successive treatment but some articles were reprocessed four times before the blistering disappeared. It appeared likely that the poor adhesion was related to this blistering tendency.

Abrasion tests on the plated articles were made and the results indicated that the adhesion was insufficient for its intended use. In other respects the behavior of the plated parts was so promising that it warranted further work on improving the adhesion. Residual buffing compounds in the surface layers were indicated as a possible cause of blistering, since repeated processing eventually overcame it. Liquid blasting the aluminum was tried to see if that would produce a cleaner surface and improve the adhesion. It was also reported[3] that high free cyanide of the copper bath contributed to blistering of copper deposits on zinc-immersion-coated aluminum. A maximum of 3 gm/l. of free cyanide was recommended. These two changes eliminated the blistering, but the adhesion was found to be so poor that adhesion specimens could not even be prepared. With the regular polished surface on the aluminum the lower free cyanide of the copper bath did not elimiante blistering entirely but reduced it so that it was only necessary to repeat the process twice. The adhesion thus obtained averaged 21,600 psi, ranging from 17,500 to 24,000 psi. The fractures were estimated to be about 50% at the bond and the remainder in the aluminum. This improvement was still considered not sufficient. Numerous combinations of pickles and pretreatments were then tried in an attempt to improve further the adhesion but they were of no avail.

Electrolytic Zincate Treatment

The idea of using current in the zincate solution was an attempt to substitute the normal displacement reaction with an anodic and then cathodic treatment. Very little blistering of the copper deposit occurred as a result of this substitution. However, it was found that the adhesion was always poor when the aluminum was made anodic. When a normal zincate immersion treatment was followed by a cathodic treatment, the blistering disappeared entirely and the adhesion improved markedly. The amount of zinc electrodeposited is critical, as too much will weaken the bond. The optimum amount was obtained under the following conditions:

1. Normal 2 min. immersion in zincate solution;
2. Cathodic in zincate solution at 2.5 asf for 20 seconds.

This treatment was incorporated with the pickling procedure (Cycle 2, Table I) as previously described

TABLE I

Pretreatment of Plating Conditions

Step	Cycle 1	Cycle 2	Cycle 3
1.	Wet pumice scrub	Wet pumice scrub	Wet pumice scrub
2.	Caustic dip	Caustic dip	Caustic dip
3.	Rinse	Rinse	Rinse
4.	Chromic acid pickle	Chromic acid pickle	Chromic acid pickle
5.	Rinse	Rinse	Rinse
6.	Zincate solution	Mixed acid pickle	Mixed acid pickle
7.	Rinse	Rinse	Rinse
8.	Rochelle Copper bath	Zincate solution	Zincate solution
9.	Rinse	Rinse	Cathodic zincate treatment
10.	Hard nickel bath	Rochelle copper bath	Rinse
11.		Rinse	Rochelle copper bath (free cyanide 3 gm/l.)
12.		Hard nickel bath	Rinse
13.			Hard nickel bath

Solutions Used

1—Caustic dip:

NaOH	50 gm/l.
150° F.	10 sec.

2—Chromic acid pickle:

CrO_3	35 gm/l.
H_2SO_4	176 "
150° F, 5 min.	

3—Mixed acid pickle:

HNO_3	3 parts
HF (48%)	1 part
70 to 80° F., 30 sec.	

4—Hard Nickel Bath:

$NiSO_4 \cdot 7H_2O$	180 gm/l.
NH_4Cl	25 "
H_3BO_3	30 "
H_2O_2 (30%)	0.4 ml/l.
pH 5.8, 125° F., 20 asf, 5 hr. for 0.005".	

5—Zincate solution:

ZnO	100 gm/l.
NaOH	525 "
70 to 80° F., 2 min.	

6—Cathodic Zincate treatment:
Zincate solution, 70 to 80° F., 2.5 asf, 20 sec.

7—Rochelle Copper Bath:

CuCN	41.3 gm/l.
NaCN	50.8 "
Na_2CO_3	30 "
Rochelle salts	60 "
Free NaCN	5.6 "

pH 9.5, 70 to 80° F., 24 asf for 2 mins., and then 12 asf for 3 mins. Articles placed in bath with current on.

and the adhesion results in Table II were obtained on polished and liquid-blasted surfaces. The fractures on the specimens with the liquid-blasted surface were estimated to be about 95% in the aluminum alloy. Further attempts were made to simplify this procedure by eliminating the strong acid pickles that were used, but no consistently good adhesion results were obtained.

Sample articles were plated by this improved procedure, Cycle 3, Table I. Abrasion tests were made and the results with respect to adhesion and wear were considered very satisfactory.

Testing Adhesion of Plated Nickel to Aluminum Sheet

An adhesion test was desired that would measure the bond strength under a pure tensile stress applied in a direction normal to the interface in a plated sheet material. A survey of the literature revealed that only a few tests measure adhesion under a simple tensile stress.[4] The method devised by *Ollard*[5] and improved by *Hothersall*[6] and *Roehl*[7] is the most satisfactory of this type, but it is applicable only to basis material in the form of one-inch diameter rods. A micro-Ollard test applicable to sheet material has been designed[8] but the details have not been described.

TABLE II

Adhesion Obtained by Cathodic Zincate Treatment

Specimens plated by Cycle 3, Table I

Aluminum Surface	Adhesion Strength, psi
Liquid blasted	44,600
	49,500
	45,700
Ave.	46,600
Polished	32,600
	42,000
	38,800
Ave.	37,800

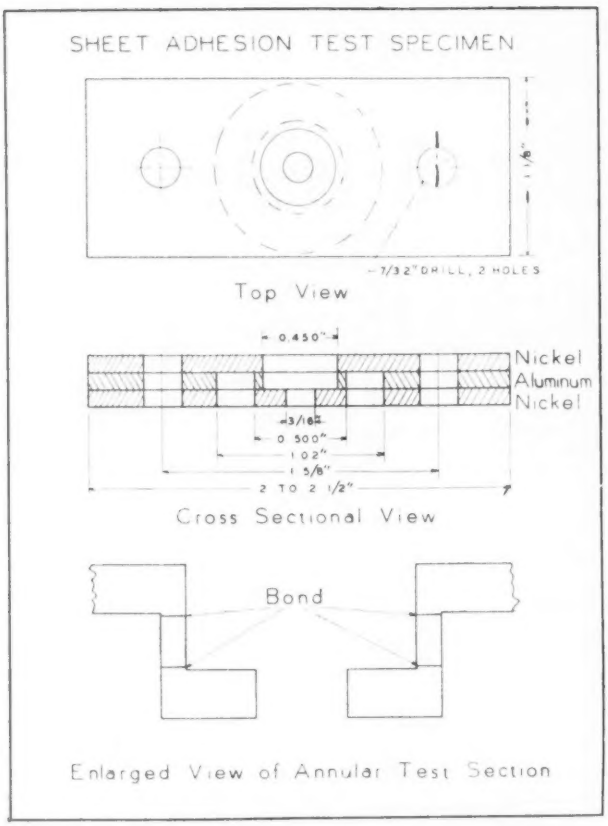

Fig. I.

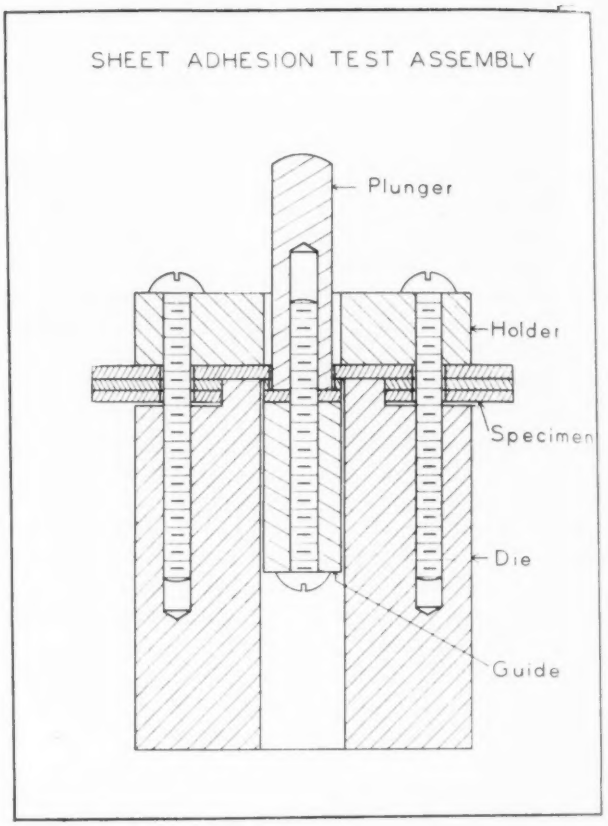

Fig. II.

An adhesion test specimen for sheet material was designed that is in principle similar to the Ollard test in that the bond area is an annular section. Figure 1 shows a cross sectional view of the specimen machined from an aluminum sheet plated with a heavy deposit of nickel on both sides. An enlarged cross sectional view of the annular section shows the position of the bonds in the specimen. Figure 2 shows a cross sectional view of the specimen mounted in the die and ready for testing. This assembly is placed between the plates of a tensile machine and the disc pushed off. From the breaking load and the area of the bond the adhesion in pounds per square inch can be calculated. The resemblance of this test to the regular Ollard can be readily seen in Figure 2. The guide, corresponding to the unplated rod of the Ollard specimen, is held firmly to the bottom side of the specimen by a machine screw threaded into the plunger on the top side. The specimen is clamped to the die by a holder to keep it in place while testing. A photograph of the specimen and assembly is shown in Figure 3.

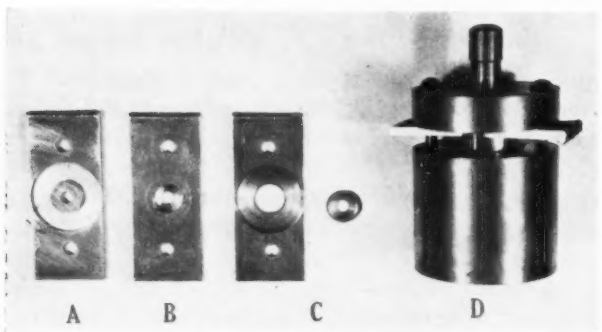

Fig. III.

A and B are views of the bottom and top of the specimen respectively, C—a broken specimen, and D—the assembly ready for testing.

Standardization of Test

Before using this adhesion test it was necessary to determine the effect of die clearance, the thickness of nickel electrodposit required, and the effect of annular test section height. The consistency and accuracy of the method were also determined.

Effect of Die Clearance

The clearance between die and specimen was found to be important in the regular Ollard test.[7] Too small a clearance caused binding, and too large a clearance caused concentration of stresses at the bond edge, resulting in low values. To determine its effect on this test two dies and two plungers were made to give

TABLE III

Effect of Die Clearance

Aluminum sheet—3SO, 0.020″ thick.
Nickel electroplate—0.040″ of chloride nickel.

Clearance (inches on Diameter)		*Adhesion Strength* (p.s.i. x 10^{-3})				
Die	*Plunger*	*1*	*2*	*3*	*4*	*Average*
0.020	0.020	12.5	13.5	13.7	13.4	13.3
0.020	0.004	13.8	13.8	15.5	12.9	14.0
0.004	0.020	14.5	13.1	13.3	15.0	14.0
0.004	0.004	11.7	14.1	13.9	16.1	14.0

TABLE IV

Effect of Nickel Deposit Thickness

Die Clearance—0.020 inch

Base	Coating Thickness: Chloride Nickel	Coating Thickness: Watts Nickel	Adhesion Strength	Cupping
2S Aluminum	0.015″		16,300 psi.	slight
"	0.036″		17,300 "	none
"		0.025″	15,600 "	slight
"		0.050″	17,100 "	none
Steel	0.030″		58,600 "	slight
"	0.060″		59,400 "	none

0.004″ and 0.020″ clearance on the specimen. All test specimens were cut from a single sheet of 3SO aluminum plated with 0.040″ of chloride nickel.[9] These specimens were broken, using four combinations of die and plunger. The results shown in Table III indicate that the clearance on both die and plunger has little, if any, significant effect on the values obtained. The large clearance has the advantage that the specimens are easier to machine, since the corners do not have to be as sharp.

Thickness of Nickel Deposit Required

The electrodeposit on the sheet has to be built up to a minimum thickness to maintain the separation in pure tensile stress. If this deposit is too thin, it will tend to cup around the top edge of the hole and a low value will be obtained because of the introduction of a shearing stress. The data in Table IV shows the effect of nickel thickness and gives some idea of the thickness required for various adhesion strengths. Cupping occurred in each case for the thinner deposit, and a lower value was obtained. *Bullogh* and *Gardam*[10] found that they also obtained low adhesion values if the nickel deposit was too thin. For adhesion strengths in the range of 15,000 to 20,000 psi a chloride nickel deposit of about 0.035″ or a Watts nickel deposit of 0.050″ is required. Adhesion strengths up to 60,000 psi require about 0.060″ of chloride nickel.

TABLE V

Effect of Annular Test Section Height

Material: 2S-½ H Aluminum rod, 1″ Dia.
Die Clearance: 0.020 inch

Height, inches	Tensile Strength, psi
0	25,200
	25,200
0.020	19,400
	19,500
	19,400
0.050	18,700
	19,000
	19,100
0.100	18,700
	18,200
	18,200
Standard 0.505″ tensile bar	19,700
	19,800

Effect of Annular Test Section Height

One of the first designs of this specimen included only one bond, so that the height of the annular test section was only a few thousandths of an inch. These specimens with perfect adhesion gave values higher than the normal tensile strength of the aluminum base. This was concluded to be due to a condition comparable to a notch on a tensile specimen. As the height of this annular section was increased, the adhesion values rapidly approached the tensile strength of the aluminum base. In order to determine the effect of this height, specimens of solid aluminum were machined from a 2S-½H aluminum rod, varying the height from 0 to 0.1″. The results in Table V confirm the notch effect at test section heights near zero. The minimum height to be used for this aluminum appears to be about 0.020″. At this height and above the measured tensile agrees reasonably well with the value obtained from a standard tensile specimen machined from the same bar.

The effect of this annular test section height is not usually important unless absolute values are required. Comparative breaking loads plus observation of location of the fracture, whether in the bond, in the base material, or percentage in the bond is often all that is necessary.

TABLE VI

Adhesion of Nickel to 3SO Aluminum

Die Clearance—0.020″
Gauge of Aluminum Sheet—0.020″
Bond Area—0.0373 square inches

Specimen No.	Breaking Load (lbs.)	Adhesion Strength (psi)
1	524	14,000
2	577	15,500
3	518	13,900
4	510	13,700
5	578	15,500
6	533	14,300
7	537	14,400
8	605	16,200
9	546	14,600
10	575	15,400
11	528	14,200
12	515	13,800
13	474	12,700
14	528	14,200
15	468	12,500
16	533	14,300
17	467	12,500
18	457	12,300
19	568	15,200
20	553	14,800
	Ave.	14,200

The effect of this annular test section height is not usually important unless absolute values are required. Comparative breaking loads plus observation of location of the fracture, whether in the bond, in the base material, or percentage in the bond is often all that is necessary.

TABLE VII

Comparison of Tensile Strength of Aluminum Alloys as Determined by Adhesion Test and Standard Sheet Tensile Test

Die Clearance—0.020″
Gauge of Aluminum Sheet—0.040″

Aluminum Base		*Tensile Strength, psi* Sheet Adhesion Test		Sheet Tensile Test
		17,200		
		17,500		18,100
		17,300		18,100
2S-½H		16,900		18,000
		17,500		18,100
		17,500		
			Ave.	18,100
	Ave.	17,300		
		20,400		21,500
3S-½ H		20,200		21,800
				21,000
	Ave.	20,300		19,700
			Ave.	21,000
		32,200		35,700
52S-½ H		31,600		36,000
				35,600
	Ave.	31,900		36,000
			Ave.	35,800
		43,800		
		45,000		
		45,400		44,900
61 ST		44,100		44,800
		43,600		44,600
		42,000		44,900
		40,400		
		42,600	Ave.	44,800
	Ave.	43,400		

CONSISTENCY AND ACCURACY OF THE TEST

To obtain some indication of the consistency of the test, a group of 20 specimens from a single plated sheet were broken in random order and the results were analyzed statistically.[11] The specimens were machined from a nickel plated aluminum sheet which did not have a perfect bond between the nickel and the aluminum. This was done because it was believed that greater deviation would occur in adhesion strength values than in tensile strength values obtained on a perfectly bonded plate. The data in Table VI give the individual breaking load and calculated adhesion strength for the 20 specimens. Statistical analysis of the data indicated evidence of control although 100 observations are usually required to demonstrate conclusively a state of statistical control.

Some indications of the accuracy of the test have been shown in Table V. Additional data to demonstrate its reliability are given in Table VII. These data were obtained from adhesion specimens on various aluminum alloys in cases where the bond was perfect and the fracture occurred entirely in the aluminum. The tensile strength of the aluminum sheet was determined in each case to compare with these data. The standard sheet tensile specimen, ASTM Designation E8-42, was used. The agreement obtained is surprisingly good considering the fact that the rate of testing and direction of tension were different in the two types of specimens.

Applications of the Sheet Adhesion Test

Many applications have been found for this adhesion test. It has been used in developing a process for electroplating adherent deposits such as described in this paper, or in checking the adhesion of a thin deposit on an article. In the latter case a heavy adherent deposit must be applied to the thin coating. The use of the test has not been limited to plated sheet material, as specimens have been cut from the coated surface of thick plates, thus testing one bond instead of two.

Acknowledgment

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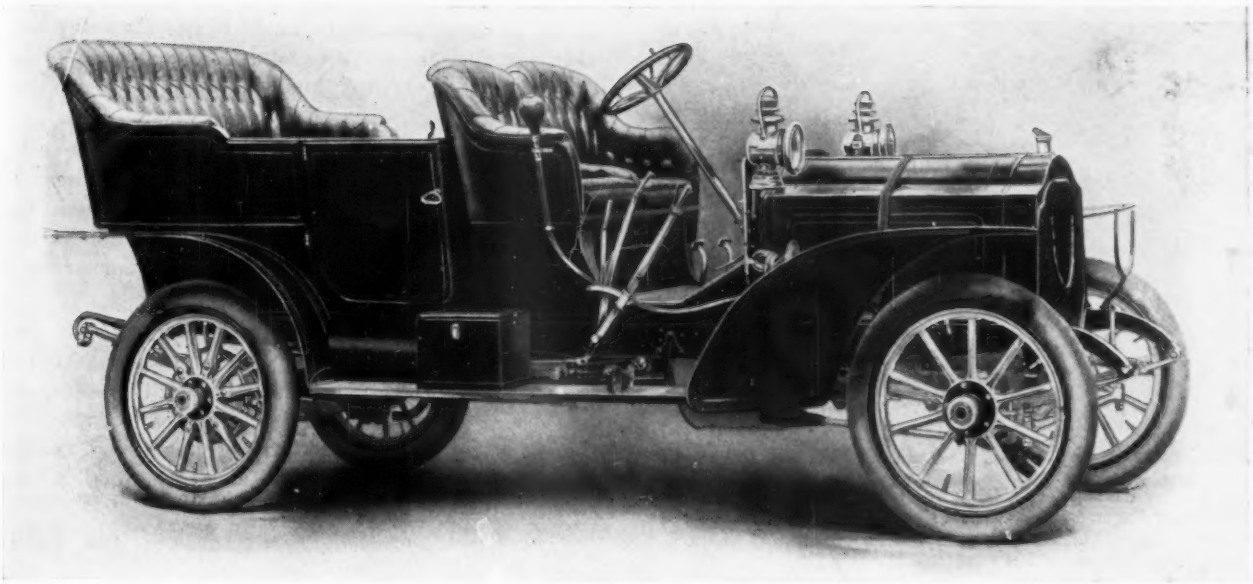


All Our Yesterdays—Part XII

By Frederick A. Lowenheim

1914 was a turbulent year in our history, and one of which we, as Americans, have little reason to be proud. It began quietly enough, and the headlines of the early months hardly foreshadowed the sensations to come. On January 5 the Ford Motor Co. announced a profit-sharing plan for its employees; on the 13th the Wright airplane patents were upheld as against the Curtiss claims. Direct wireless communications with Germany from Sayville, Long Island, was instituted on the 28th. Teddy Roosevelt, no longer in the White House, was still in the news: his Brazilian expedition traced and surveyed the hitherto unexplored Rio da Duvida (River of Doubt). The rising tide of Prohibition engulfed Tennessee in March, West Virginia in July, and in November was voted in Arizona, Washington, Colorado and Oregon. Secretary of the Navy Daniels issued his famous order prohibiting the use of alcoholic beverages on naval vessels or in naval stations on April 4. One of the country's most prolific and successful inventors, George Westinghouse, died on March 12. Of more direct interest to platers was the death on January 31 of Erwin Starr Sperry, one-time editor of METAL INDUSTRY (now METAL FINISHING) and founder and publisher of the competing journal, the BRASS WORLD AND PLATER'S GUIDE. And just to make everything regular and orderly, the usual strike of coal-miners took place on April 1.

The American Electroplaters' Society may be said to have come of age during the year. An important and widely-publicized joint meeting of the Newark and New York branches was held in February. There was a genuine joy in the greetings and a frank and unrestricted exchange of ideas among the members. In the after-dinner speeches emphasis was given to the mutual benefits to be derived from the cooperation of the electrochemist and the electroplater. One speaker remarked: "The noblest work of God is a competent chemist." (Well, gee, thanks.) "To be masters of your profession you must know the chemistry of plating."

Another speaker wondered about the low esteem in which the plating department was held—and again, my readers may recognize the tune: "It is rather hard to understand why the average manufacturer, no matter how progressive he may be, does not give the plating department the attention this very important branch requires." He will, the speaker complains, keep his machinery up to date but he neglects the plating room.

"The fact that the plater has been ignored is, in a way, his own fault. He has not been as progressive as he might have been. He has for years been satisfied to work with materials the ingredients of which he did not know, and often did not care to know. I am indeed sorry to say that this condition has caused the unscrupulous dealer in chemicals to take advantage of the plater by adulterating and mislabeling the various chemicals as put on the market. The plater must take a more active interest in what he buys and where he buys."

In June the "second annual convention" of the A.E.S. was held in Chicago, though one reporter remarked that it was really the first true convention of the Society.

Speakers at this convention continued to stress the vital necessity of cooperation between the plater and the chemist, and of chemical education for the plater; but we shall spare the reader further quotation. And

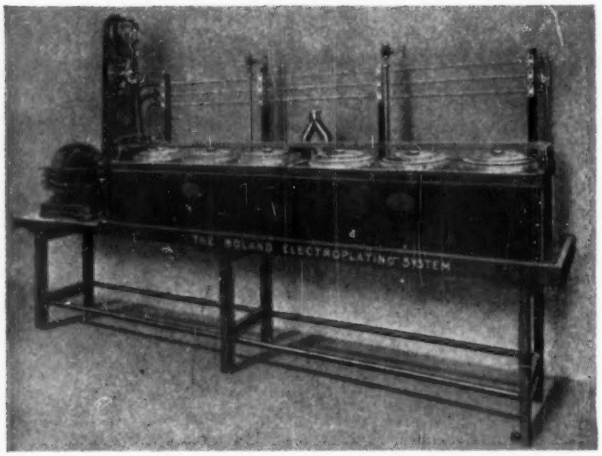


Figure 1. A complete unit for plating jewelry as manufactured by the Holtzer-Cabot Electric Co. in 1914. This is believed to be one of the first units of its kind.

to round out a banner year, the Society issued the first number of the Monthly Review.

The plater's progress was not confined to the affairs of his Society, however. New developments were coming along at an accelerating pace: one new trend was the development of more concentrated solutions which permitted higher currents and faster production. As we have seen, new proprietary salts had been placed on the market embodying the principle of higher rates of plating, and they had been the subject of a good deal of discussion, pro and con. Mr. C. H. Proctor advocated an open mind toward the flood of new "Platers' Salts" and the claims made for them: "Every new addition of salts that come upon the market is well worth considering, if the claims made for them can be substantiated in practice. Unfortunately too many claims are made for certain products."

"Let us keep as near to the truth as possible, although we have no pure chemical laws that will guarantee to the plater that the material consists of certain guaranteed compositions and these only. Yet it is due to him as a consumer and to all legitimate manufacturers of chemicals or supplies in electroplating to be able to guarantee that the article is as represented. *The plater will then have faith in salesmen* and a new era for the plating industry will commence in the year 1914."

Controversy over the merits of the new high-speed nickel salts continued lively: the pages of the trade journals were given over to letters from manufacturers' representatives extolling the virtues of one or the other proprietary mixture, and to answers from platers who had tried them—these latter being sharply divided into the pro and anti. These exchanges of opinion are too long to permit quotation here, but the modern reader is forcibly struck by the frankness with which the plater of 1914 vouchsafed his opinions, and by the liberal manner in which the trade journals opened their editorial columns to "free advertising."

Turning from controversy to humor, we quote some animadversions on "Salesmen" contributed by an obviously harrassed purchasing agent: "Let me describe a few of these types: The inebriate whose breath precedes him into your office by about ten feet is not as uncommon as he ought to be. How any concern can have the nerve to send such men on the road and expect to do any business through them is a mystery to me.

"Then we have the salesman with the 'voice' who may otherwise be a good man, yet as his foghorn is always in splendid condition, he dilates upon the virtues of his goods in tones that could better be employed announcing quitting time in a boiler or drop forging shop.

"The fresh young salesman whom somebody has 'wished' on a long suffering public is familiar to all of us. I recall such a salesman. By a little kind questioning it developed that he was the stenographer of the office force and things being slack they chased this young fellow out on the road to sell goods about which he knew very little.

"The flashily dressed salesman whose pink socks, green shirt, blue hat and heliotrope vest are one disdisconcerted 'scream,' is not such a bad fellow for all that. Then we have the pipe-smoking salesman whose person and breath exudes an odor second only to the one manufactured at Barren Island and who will, on occasion, stride into your office with his pipe stuck in his face and feels very much hurt when the office boy is ordered to open all the windows and doors so that one will not suffocate. I cannot express in polite language my opinion of the cigarette dope." And so on.

Meanwhile the tempo of events in the world outside the plating shop was increasing. On April 9 some American marines, landing at Tampico, Mexico to replenish stores, were arrested in error but later released. Our government demanded an apology and further stipulated that the Mexicans salute the American flag as a gesture of reparation. The further development of this little contretemps reads today like two little boys making faces at each other over a back fence:

April 11: President Huerta of Mexico apologizes but ignores the salute to the flag.

April 12: Secretary Bryan insists on a salute.

April 13: Huerta agrees to salute on condition that we will in turn salute the Mexican flag.

April 14: Fourteen battleships are ordered to Mexican waters.

April 16: Huerta agrees to salute, U. S. to return the salute "as a matter of international courtesy."

April 18: President Wilson presents an ultimatum to Huerta: Unconditional salute to the American flag before 6 p.m. tomorrow.

April 19: Huerta rejects ultimatum.

April 21: Vera Cruz occupied by American marines.

April 22: Our chargé in Mexico handed his passports.

April 25: U. S. accepts offer of mediation by "ABC powers" (Argentina, Brazil and Chile).

All our troubles were not external, however. There were two "marches on Washington" by armies of unemployed, and the usual number of strikes. April 20 was a black day in the history of our labor movement, when state militia set fire to the tent colony of some striking miners in Colorado: 25 persons, including 11 children and 2 women, died in the "Ludlow Massacre;"

and on the 28th Federal troops were ordered to the scene to replace the militia.

To return to our trade jouranls: occasionally one comes across ideas which, basically sound, appear to be many years ahead of their times. One such, published in 1914, is headed "Shall We Have a Tin Famine?" "From time to time we are threatened with scarcities of various sorts, not only of food but of other materials necessary to use in our daily vocations —coal, wood, copper, india rubber, etc., and now, as a subject of alarm, comes tin.

"We have substitutes for several of the materials which bade fair to become scarce, but as yet there is nothing known which can replace this metal. The price is rising steadily, and the production decreasing, while the demand is constantly increasing. The earth's surface has been, as it were, searched with a fine-toothed comb, but new mines are not found, unless, as was the case some years ago in America, they have been 'salted.'

"This scarcity touches very closely all those businesses in which iron or other metals are coated with tin by the 'heat process.' Zinc will do for some purposes, lead for some others; mixtures of these and of antimony, with tin, have also been tried.

"This lack of tin comes home to all of us, as the greater quantity is used for coating sheet iron or sheet steel, and the greater portion of this latter material is used for air-tight cans for fruit, etc.

"As far as I can see, the only help which at present offers itself in this direction is to drop the process of coating sheet iron and steel by immersing in a bath of melted tin, and take to galvanic deposition, which effects the coating much more regularly, and at the same time is accompanied by no waste through alloying of the iron with the tin in the bath."

Here are some miscellaneous observations culled from these old pages, which I quote without comment as indicating the state of the art just before World War I broke.

"Is the quick dip necessary in silver plating? The quick or blue dip is used to bind the silver to the base metal (at least this is what the text books tell us). It consists of a weak solution containing mercury into which the article to be plated is dipped previous to the electrodeposition of the silver. Although used by the largest and best concerns doing silver plating, the question has recently come up, whether it is not superfluous. To come to the point more quickly than an author apparently trying to fill space, the objections appear to be that it may stain, the mercury deposit may be too heavy and cause season-cracking. "There are many platers, and those who have done good work for years, who have never used a quick dip at all, and yet their work compares equally with others who do use it. An excellent argument against the quick dip was recently put forth by a very experienced silver-plater. He has found in a number of instances, quick dips that have been exhausted and still were being used from day to day. No difference was found in the quality of the work and the burnishers, who are the barometers of the quality of the silver deposit, made no complaint."

Figure 2. Plating room at the R. H. Macy Company store in New York in 1914. Over 48,000 separate plating jobs and repairs were completed in this department during the year.

Electroplating zinc-alloy die-castings: "The advent of die or pressure castings into the commercial world is one of the most important additions to the metal industry in several decades. These alloys give a strong, homogeneous, and compact metal and come from the dies as perfect machined castings, requiring very little labor to assemble. Many electro-platers who have had no experience in plating zinc-alloy die-castings look upon them as a difficult problem to contend with. This is not the case, as they are not more difficult to electroplate than iron or steel." (Since I promised to quote without comment, you will have to make your own rebuttal to that one.)

Nickel-Plating Aluminum: "A communication has just been presented to the Académie des Sciences in which the author states that he has succeeded in nickel-plating aluminum. Until now it has been impossible to cover aluminum with any kind of metallic layer by the methods in use. This has considerably prevented the extension of employment of this metal which lends itself to so many purposes, but its dull appearance, especially after prolonged use, has been much against it. The difficulty has been surmounted by a preliminary scouring of the aluminum in a bath of hydrochloric acid containing a certain proportion of iron. The iron precipitated on the surface of the aluminum forms a kind of network and when the piece of metal is next passed into the nickel bath the nickel gets entangled, as it were, in this network and adheres strongly to the aluminum. This process, which is based upon an action which is purely physical, appears capable of solving a problem hitherto considered insoluble."

Electrodeposition of Aluminum: "The leading dental and surgical manufacturers of America and England voted to give $100,000 to the electroplater who could build up an aluminum-plating solution for the deposition of aluminum on dental and surgical instruments. A guarantee had to be given that the metal deposited would not blister or peel off in any way. [A solution tried by the writer's father and found to give good aluminum deposits was composed of aluminum chloride, sal ammoniac, sodium bisulphate and tin chloride." According to the writer, this gave a good deposit of "aluminum," which however would not stand up under corrosive conditions.]

Finally there are some interesting ideas on chemistry in an article on acid copper plating: "Acid copper baths scarcely ever need addition of sulphuric acid when once prepared. Free acid is constantly formed in solution while deposition is taking place. Alum will neutralize the free acid, forming aluminum sulphate which has been found very beneficial in electrogalvanizing baths and when added as alum (the double sulphate of aluminum and potassium) *neutralizes* the free acid and gives excellent results in the acid copper bath."

I am sure no plater of 1914 would have passed over an article intriguingly titled "Electroplatology (The Science of Electroplating.)" Nor does interest flag as we read on:

"Of late in some of the trade journals catering to the plating industry there have been published articles calculated to benefit the plater. The gist of their contents, however, is nothing more or less than an argument in favor of a special brand or apparatus manufactured or sold by certain parties, and in most cases written by a member of the firm making it or by a representative of that firm.

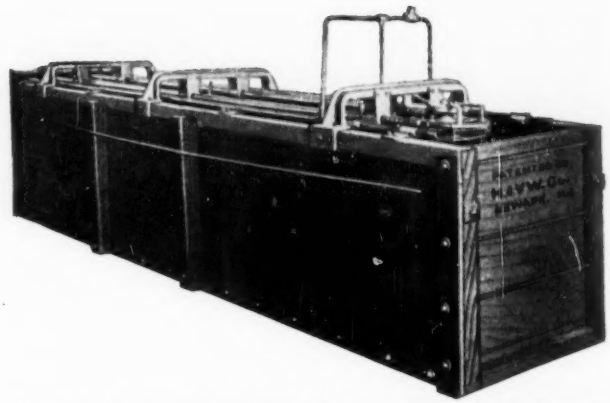


Figure 3. An automatic plating unit as marketed by the Hanson-Van Winkle-Munning Company in 1914. A screw conveyor moves the parts through the plating bath.

"I have nothing to sell; I am a plater myself, still in the harness. I will endeavor to point out the path to be followed if you would become a competent and successful plater.

"It was in the early eighties when I entered the employ of a plating shop, and strange to say I was made foreman from the beginning. The proprietor would sleep by day and play poker by night. The management of the business was left entirely with me. I was to open the shop in the morning, close at night, have the work delivered, do the collecting, keep a record of the business, and see that all hands were kept busily at work, for all this and *more* I was to receive my 'keeps'—board and lodging—and the munificent sum of fifty cents a week. I had never seen a plating shop nor heard of electroplating before, and you can imagine my consternation when I entered the plating shop of thirty years ago. But I thought 'no workee-no eatee' and so I took the job.

"The very first day of my employment I conceived a little contrivance, a little instrument without which no man can ever hope to be a success in any line of endeavor. I spent weeks and months, yea years, in its development. The plating room is incomplete without the hydrometer, without the voltmeter and without the amperemeter, but the meter, the instrument of which I speak, is more necessary than any of the above, and I will describe it in the next issue and give it to you free, without money and without price." Now that, you will agree, is a pretty good buildup, and if you had been a subscriber to this trade paper I think you would have looked forward to the next issue with a certain amount of anticipation. The next issue, however, would have let you down: no continuation. Look back—yes, it definitely says, "To be continued." Some slight delay in publication, perhaps; let's wait for next month. Lots of good articles next month, but no secret instrument. And so on throughout the year: and so I am very sorry, but I am going to disappoint you just as the author of that article on "Electroplatology" did me. For all I know that secret instrument

was the atomic bomb, and you know what happens to people who go blabbing about that.

Did you ever think that the profession of electroplating had its poetical side? Maybe the confusion comes about through the supposed similarity between a dynamic ammeter, a static hydrometer, and an iambic pentameter; in any case, every now and then our plater of 1914 erupted into verse, and what is more, got it published. Witness:

THE JOYS OF A PLATER

A plating room and a steamboat
Are very much the same.
In regard to the men who run them,
Just a difference in the name.

The foreman acts as pilot
To keep them off the rocks
And he's the unlucky victim
That everybody knocks.
From seven in the morning
He must be looking out for squalls
And if everything don't go just right
He's sure to get some calls
From an angry superintendent,
With a letter in his hand,
Who jumps into the plating room
Like half a ton of sand.

"The nickel is full of scratches,
The brass is tarnished bad;
It is not as good as Flitch's
It is the worst we ever had."
If the packing room is leaky
And one-half the goods get wet,
If the tariff causes a panic,
And orders are hard to get;
If the package contains a shortage,
Or the goods have holes in the stock,
Don't hesitate a moment
To give the plater a big knock.

Possibly the most significant development of the year in its long-time effects was the introduction to the plating trade of commercial metal cyanides: copper and silver appeared to be the first. That the announcement of these materials was accomplished to a large extent by the kind of "free advertising" I have spoken of earlier does not detract from their importance. Readers of the earlier parts of this series may remember that the plater of 1904 had to be his own manufacturing chemist, preparing copper carbonate from soda ash and copper sulphate, or silver chloride by precipitation from the nitrate. The chemical industry finally came to his rescue: "It has long been known that the highly concentrated cyanide of silver and cyanide of copper are the ideal replenishing salts, but their use has been somewhat restricted on account of the high cost of the same. The plater will therefore welcome the announcement that copper and silver cyanide are now being manufactured in a commercial way by one of the largest chemical companies [Roessler & Hasslacher Chemical Co.] so that this material is now sold at a price which compares favorably with the less satisfactory chloride and nitrate of silver and copper carbonate of more or less doubtful purity now on the market."

As the year progressed, zinc cyanide was added to the list and a heavy barrage of articles and advertisements was directed at the plater to convince him of the superiority of the new materials. Editorial notice was also taken of the new development, which from all appearances was off to a promising start.

Late in the year one correspondent rebelled at the number of self-serving articles written by representatives of supply houses and unburdened himself of the following:

"I have always maintained that the surest way to get into all kinds of expensive trouble and jeopardize the quality of the output in any plating establishment is to buy the ready-made solutions or the so-called plating salts.

"My idea in writing this is not to cast aspersions or 'start something,' but simply to call the ordinary plater's attention to the fact that the figures and conclusions arrived at in all articles, but especially in those written by agents for platers' supply houses, should be carefully studied before being accepted as positive facts."

It seems to this writer that the above letter highlights a problem which faces all technical societies and trade journals, for it is natural that industries which have developed new and worth-while products or processes will want to publicize them, and this cannot be done entirely through the medium of paid advertising. Nor would it be to the advantage of the profession as a whole to suppress articles just because they might be self-serving. The problem is a continuing one which is just as vital today as when it annoyed our correspondent of thirty-five years ago.

You might be interested in some prices from that year:

	May 1914	*October* 1914
Copper	14.5c	12.25c
Tin	34.0c	31.25c
Lead	3.9c	3.7c
Zinc	5.1c	5.1c
Aluminum	23.0c	24.0c
Nickel	43.c	43.c
Cadmium	95.c	$2.25

(In Sept. 1914 it was $1.25 lb.)

As I have remarked before, speculating in cadmium looks like fun!

As we approach the end of our allotted space, we can only mention some of the other subjects which were engaging the attention of the plating fraternity. The question-and-answer columns ran to routine inquiries on how to plate iron, nickel, tin and the like; and if we may judge from the contents of these pages, the plater was getting into fewer ridiculous predicaments than his colleague of ten years before. There was, however, a minor epidemic of putting nickel solutions into dirty containers with disastrous results:

Q: In moving our nickel plating plant, we put part of our nickel solution in vinegar barrels and part in a galvanized iron tank. The solution now plates dark. What is the cause and how can we overcome it? A:

(*Concluded on page* 67)

Will tomorrow's plating be done this way?

(*Photo courtesy Leeds & Northrup Co.*)

Where Do We Go From Here? Part III—Water Control

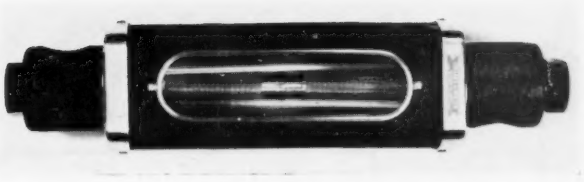
By **Joseph B. Kushner**, *Electroplating Engineer, Stroudsburg, Pa.*

IN most of the chemical process industries involving the use of water, careful control is exerted over the quality and amount of water used at every step of the process. Process water is controlled as to quality because its quality determines the quality of the final product, and it is controlled as to quantity because the existence of a process may depend purely on its economics, and water is one of the factors effecting the final cost.

On the other hand, in the electroplating industry, where water is truly the "life blood" of the process, little or no thought is given to control of either quality or quantity! It is only in the past few years that attention has been drawn to the fact that the quality of the water used in the plating room is of vital importance to good results and trouble-free plating,[1, 2, 3, 4, 5, 6] and it is only in the immediate past that serious attention has been called to the economical use of water in the plating process.[7] It is about time the industry realized that good drinking water is not necessarily good for plating, and that good plating water is not as abundant and free as the air! When you stop to think that the ordinary plating plant may use anywhere from 4,000 to 40,000 gallons of water a day, you begin to realize that water control in the plating room is no "small potatoes!"

What is "water control?" In essence, water control consists of two things; 1) Determining the quality of water to use in the plating room and producing it for use there. 2) Determining what amount of this water is to be used for optimum results and regulating the flow thereof so that only this amount is used.

Just as in plating bath control where we use ammeters for measuring the flow of electrical current, voltmeters for measuring the electrical pressure, rheostats for regulating the current flow, and analyses for determining the composition of the plating bath, in water control we have flowmeters, such as rotameters, (Figure 1) for measuring the flow rate, pressure gauges for determining the water pressure, valves for controlling the flow and analyses for determining the quality of the water. In other words, you cannot expect to exert "water control" unless you have the instruments and equipment for measuring and regulating, just as you cannot expect to exert plating bath control without the necessary appurtenances. With this clearly



(*Courtesy of Fischer & Porter Co.*)

Figure 1. A commercial form of flow-rate measuring device.

in mind, we can proceed with the discussion.

Quality Control

On the point of quality control, the answer is simple and clear cut. Developments of recent years have shown that it is possible to produce water of any desired quality, from a given source of raw water, efficiently and economically, by the process of deionization.

Water deionizers are now readily available that will turn out from 1 to 100 gallons a minute, purified to the right degree for plating use. While at present there is no standard specification chart for water to be used for plating purposes, some day there will be, thanks to data that is being uncovered by Research Project No. 6 of the *American Electroplaters Society*. In the meantime there is a rudimentary chart prepared by *Morral*[4] and data given by *Diggin*,[6] which can be used in setting the required quality of water to use. If a water analysis shows that the use of the local raw water will lead to poor results in the plating room, a deionizer can be installed to purify the required volume of water daily.

Quantity Control

Quantity control of water in the plating room is somewhat more involved and admittedly more difficult to arrive at—but—it can be done! Progressive plating executives who demand it and get it will find that it pays in dollars and cents. It is this writer's aim to show that quantity control of water used in the plating room can be established and that this control, when exerted, will more than pay for itself.

Water is used in a plating room in two ways. 1) It is used to make up the plating baths. 2) It is used for rinsing work between and after plating and dipping.

From the standpoint of quantity, the first use is relatively minor since the baths, once made up, suffer only comparatively small water losses through evaporation or dragout.

It is the second use of water, for rinsing, that is the most important use in the plating room from the standpoint of *quantity*, and surprising as it seems, *quality*. This latter point should perhaps be explained first.

Let us pre-suppose that the water in use in a given plating room, whether raw or deionized, is perfectly satisfactory for plating use from a quality standpoint. This water will also be used in the rinse tanks as well as the plating baths (using deionized water for making up the plating baths only is not enough! See *Hogaboom*[1] and the writer[2] on this subject). The rinse tanks in the plating room are used as washing mediums between the various baths and dips. The rinse tanks then, stand guard between these baths to keep one solution from mixing with another and contaminating it. Yet it is *inevitable* that a certain amount of one bath will be carried over into the next bath through the intervening rinse tank, because of drag-in and drag-out. Accordingly, the *quantity* of water flowing into the rinse tank, which determines the concentration of the carry over to the next plating bath also affects the ultimate *quality* of the plating!

The Function of a Rinse Tank

In order to establish control in any process, we must know what we are setting out to do. *In rinsing, our purpose is to remove completely the dissolved substances that cling to the work in the form of process solution.*

Consider the simple single compartment rinse tank shown in Figure 2. A load of work carrying an average amount of drag-out, θ gallons, in which the concentration of solids is C_o ounces per gallon, goes into the rinse tank of volume V gallons, where it mixes with the running water, flowing at a rate of Q gallons per minute. The work is rinsed and leaves the rinse tank with approximately the same volume of drag-out, θ, as before, with a new concentration, C_r as regards the dissolved substances.

According to the definition of rinsing we have just given, our purpose in rinsing is to make C_r equal to zero.

From a practical standpoint, this unfortunately cannot be done without using enormous amounts of water in the rinse tank. Therefore we must compromise and formulate a more practical definition of good rinsing. We change our definition, accordingly, to:

"In practical rinsing, our purpose is to remove *as much as is required* of the dissolved substances that cling to the work in the form of process solution."

How much is "*as much as is required?*" This quantity is vague as it stands, and a definite numerical measure must be made use of, if control is to exist. This writer therefore proposes the following criterion, to be known as the "Rinsing Criterion":

> *The ratio of drag-in to drag-out at the rinse tank, with respect to the concentration of substances therein contained, shall be known as the rinsing criterion.*

Mathematically speaking,

$$R = Co/Cr$$

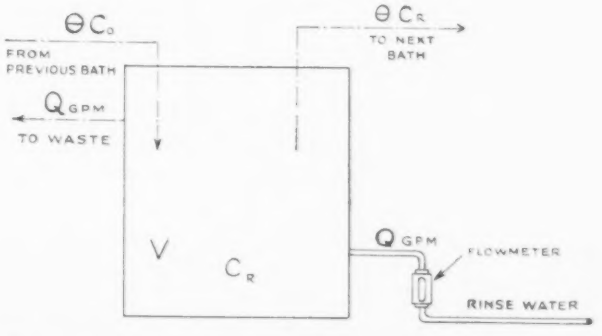


Figure 2. Simple rinse tank used to illustrate the meaning of Rinsing Criterion.

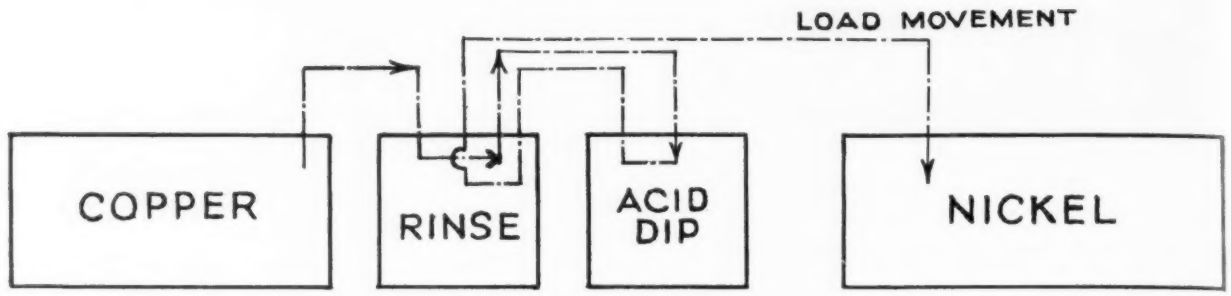


Figure 3. Mutual rinse tank.

where R is the Rinsing Criterion. Thus, in the case of perfect rinsing, C_r is O and R is infinity. For all other values of C_r, R is a definite number. The larger R is, the better the rinsing process and the smaller it is, the poorer the rinsing process.

To give an actual example, suppose the concentration of solids in a plating bath is 10 oz. per gallon. The work is rinsed after this bath and dried. Tests show that in order for the work to dry stain free, the rinse water must have a concentration of solids, no higher than .001 oz. per gallon. The *rinsing criterion* for this tank will therefore be 10/.001 or 10,000. While R may be more than this value, it can never be less if stain-free work is to be produced.

For each and every rinse tank used in the plating room there is some such criterion. In some cases, as above, it is obvious, in others it is not so obvious, but it exists nevertheless and if it cannot be determined, will have to be assumed, in order to establish water control.

Take the case of a mutual rinse tank diagrammed in Figure 3. It is used to rinse off rochelle copper solution and also as an after rinse for the acid dip, prior to entering the bright nickel bath. Poor practice, we'll admit, but something that is frequently seen in plating shops! What is the criterion here?

Of all the ions that can be possibly found in the rinse tank, bright nickel will be most sensitive to copper. Actual tests have established that .002 oz/gal of copper is definitely harmful to bright nickel. Accordingly, if the copper ion concentration in the copper bath is 3 oz. per gallon, the Rinsing Criterion will be for this rinse, 3/.002 or 1500.

To prevent harmful contamination from this source at any time whatsoever, R must be no smaller than 1500.

In other words, in establishing the Rinsing Criterion for a given rinse tank, look for a substance, ion or compound, that may be present in the rinse water, and to which subsequent baths or dips are sensitive, and use it as indicated above. Below is a chart of estimated Rinsing Criteria for various types of rinse tanks. Some of these values, which have been estimated based on average plating solution concentrations, may be in serious error, as sufficient data has not been established by research. If they are in error, the error is on the conservative side, and these values may be used as a first step in establishing water control in the plating room. The list is necessarily incomplete, as the positions of the rinse tanks will be varied.

Type of Rinse Tank	Rinsing Criterion
Rinse after alkaline cleaner	5000-7000
Rinse after acid dip	2000-3000
Rinse after cyanide dip	3000-5000
Rinse after cyanide copper	1500-2500
Rinse before drying (better work)	10,000
Rinse before drying (cheaper work)	5000

The Rinse Tank Equation

In a recent article,[7] the writer has shown that in a given *single compartment* rinse tank used in an automatic plating process, or in a manual plating process that is operated with regularity, the concentration of a substance or ion that is being carried into it from a previous dip is given by the expression:

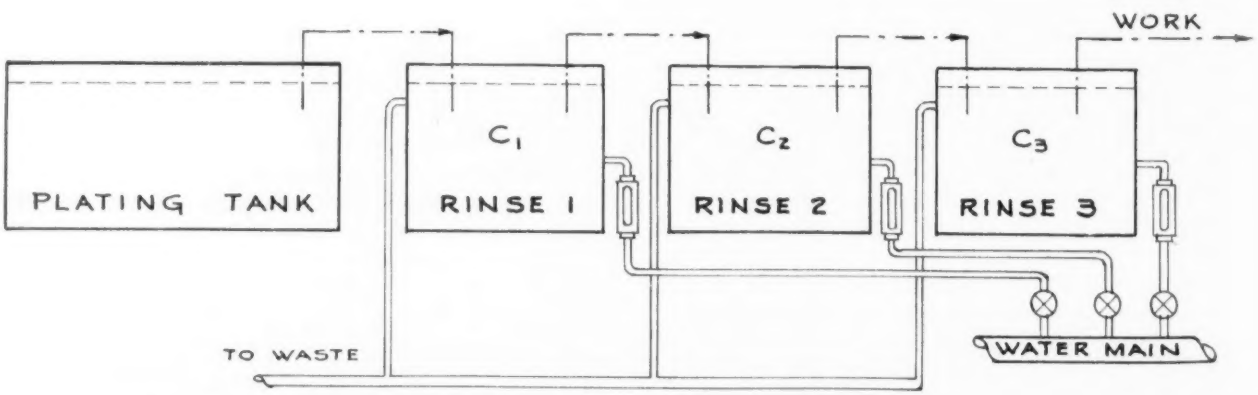


Figure 4. Parallel water feed of rinse tanks.

$$C_r = \frac{C_o \theta}{V}\left(\frac{e^{-\frac{pQ}{V}}}{1-e^{-\frac{pQ}{V}}}\right)\left[1-e^{-\frac{Qt}{V}}\right]$$

Where C_r = concentration of substance in the rinse tank.
t = length of time rinse has been in operation in minutes.
C_o = concentration of substance in previous bath (oz/gal).
θ = average dragout per load rinsed in oz./gal.
p = time interval in minutes between loads.
V = volume of the rinse tank in gals.
e = base of natural logarithm 2.718.
Q = rinse water flow rate in gals./min.

After a period of operation, depending on the constants in the given case, the expression in brackets approaches unity and can be disregarded, leaving the equilibrium concentration in the rinse tank with respect to the substance,

$$C_r = \frac{C_o \theta}{V}\left(\frac{e^{-\frac{pQ}{V}}}{1-e^{-\frac{pQ}{V}}}\right)$$

The expression $\frac{e^{-pQ/V}}{1-e^{-pQ/V}}$ is a constant which may be considered as the *rinse tank constant* for the given mode of operation. If pQ is small as compared to V, which is usually the case, $e^{-pQ/V}$ can be set equal to $1-pQ/V$, and if this is done and the division is carried out we get as a final result,

$$C_R = C_r = C_o \frac{\theta}{V}\frac{(V-pQ)}{pQ} \qquad (4)$$

If we take the C_o over to the left side and remember that $C_o/C_r = R$ we can invert both sides and obtain as a result

$$R = \frac{VpQ}{\theta(V-pQ)} \qquad (5)$$

Since R is the *Rinsing Criterion* and the larger R is, the better the rinsing is, inspection of the equation will indicate what can be done to improve rinsing. There are 4 variables to be considered.

1. Increasing V in size. This decreases R, inasmuch as V appears on top and bottom and is generally much larger than pQ. To give a numerical example, if V originally is 25 gallons, p is 3 minutes and θ is .1 gal. and Q is 2 gpm, R is 80. If V is increased in size to 50 gallons, R becomes $\frac{50 \times 3 \times 2}{.1 \times (50-3 \times 2)} = 68!$

2. Decreasing V in size. This actually results in an increase in R, as will be noted above. However, the change is not drastic and considering the fact that there is a lower limit to the size a rinse tank can be made, not much room is available for variation. However, there is a hidden benefit not indicated in the equation, that of better mixing, the smaller V becomes. This gives a very important point in designing a rinse tank. *Make the rinse tank or compartment as small as possible, compatible with easy handling of the largest contemplated load.*

3. Increasing p. While effective in raising R, this cannot be considered as it increases production time.

4. Decreasing θ. This also is effective but only to a limited extent. There is a lower limit beyond which θ cannot be reduced, and attempting to reach that limit results in too much lost production time. This therefore is not too promising.

5. Increasing Q. This is obviously the best and most promising method of increasing R, since it has the double effect of increasing the numerator and reducing the denominator of expression (5). If, in the previous example, with the 50 gallon tank we increase the water flow rate to 10 gpm, R becomes 750!

Rinse Water Flow Rates

If equation 5 is solved for Q, the water flow rate, we obtain

$$Q = \frac{\theta R}{p(1+\theta R/V)} \qquad (6)$$

Let us see how this works, with an example. In a rinse after cyanide copper, the criterion is 2000. θ is .05 gal. per load, V is 50 gallons, p is 2 minutes. What will the water flow rate have to be to maintain this value of R?

$$Q = \frac{.05 \times 2000}{2(1+.05 \times 2000/50)} = 16.6 \text{ gpm.}$$

This of course is a very high water flow rate and a means must be sought for reducing it to a reasonable

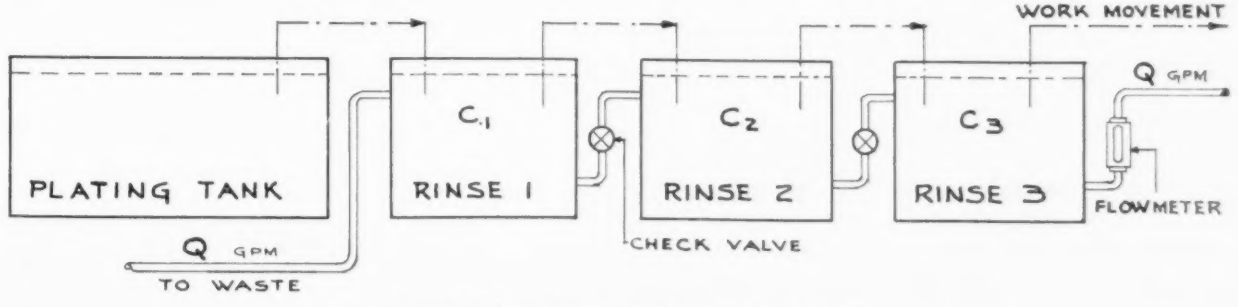


Figure 5. Cascade, or series, feed of rinse tanks.

value. It was shown by the author in the previously mentioned paper that in a series of rinse tanks or a multi-compartment rinse tank where each tank or compartment has the volume V and the direction of water flow is counter current to the direction of the work movement, the limiting concentration of an ion entering the system, in the nth tank or compartment, is given by the expression,

$$C_n = C_o \left(\frac{\theta}{V} \right)^n \left(\frac{V - pQ}{pQ} \right)^n \qquad (7)$$

Where n is the number of tanks or compartments, and the other symbols have the same meaning as before. This expression holds strictly true where each tank is individually fed with water (parallel connection) Fig. (4) and is approximately true where the tanks are fed in cascade (series) Fig. 5, provided pQ is at least 100 times greater than θ.

If this equation is solved for Q to bring about the desired value of R ($R = C_o/C_n$, in this case) we get in the same form as before,

$$Q = \frac{\theta R^{1/n}}{P(1 + \theta R^{1/n}/V)} \qquad (8)$$

except that now the nth root of R appears instead of R itself.

With θ small as compared to V, which it always is, with rare exception, θ/V multiplied by $R^{1/n}$ will be small as compared to unity, if n is at least 2, therefore as a very good approximation, we can write, where n is 2 or more,

$$Q = \frac{\theta R^{1/n}}{p} \qquad (9)$$

This is the design equation that can be used in designing rinse tanks and estimating rinse water needs.

As an example let us take the case studied previously where a flow rate of 16.6 gpm was found necessary. If we use 2 compartments, n = 2 and

$$Q = \frac{.05 \times 2000^{1/2}}{2} = 1.12 \text{ gpm!}$$

If the compartments are fed with individual water supply a total of 2.24 gpm will be needed, roughly an 8 fold reduction in the amount of water used for 1 tank! On the other hand if the tanks are fed by the cascade system which requires a slight drop in water level, only 1.12 gpm will be needed, with a saving of 93% on the water bill!

A three compartment rinse system will require a flow of only

$$Q = \frac{.05 \times 2000^{1/3}}{2} = .36 \text{ gpm.}$$

And a 4 compartment rinse tank will require a flow of only .17 gpm. With individual feed to each tank the total amount of water used will be .68 gpm.

A chart based on equation 9 is shown in Figure 6. This answers any problem in connection with the

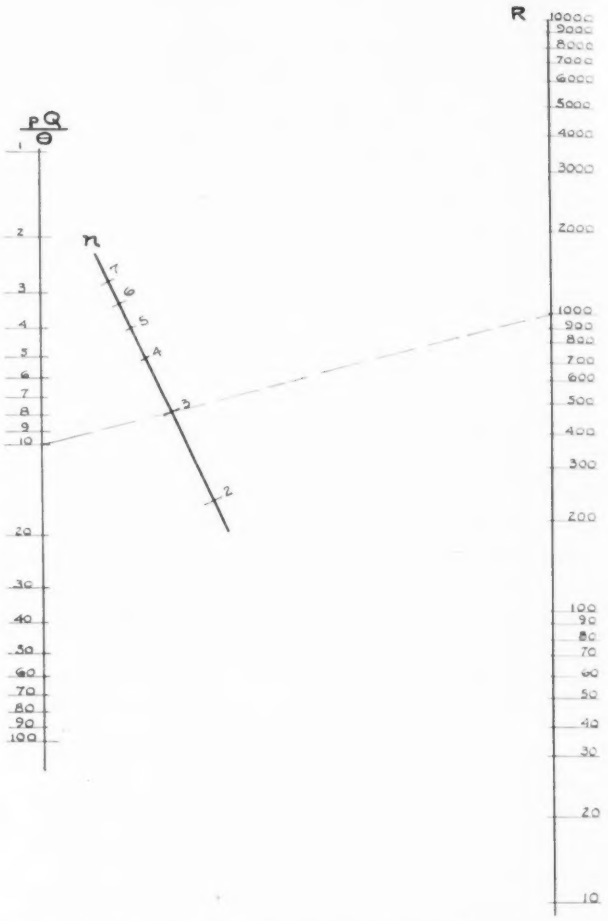


Figure 6. Chart for determining required water flow for two or more rinse tanks with multiple or cascade feed.

equation and may be used in designing rinse tanks and estimating water flow. For any desired rinsing criterion, R, we can determine the value of $\frac{pQ}{\theta}$ for any given number of rinse tanks or compartments, from 2 to 6. Knowing p and θ, we can determine Q.

In general the gravity feed method will result in the lowest rate of water use, but in order to utilize it there must be a drop in water level between the compartments (a 2" drop overall will be enough to put through water at 1 to 2 gpm, through a 4 compartment rinse) and check valves must be employed to prevent back flow.

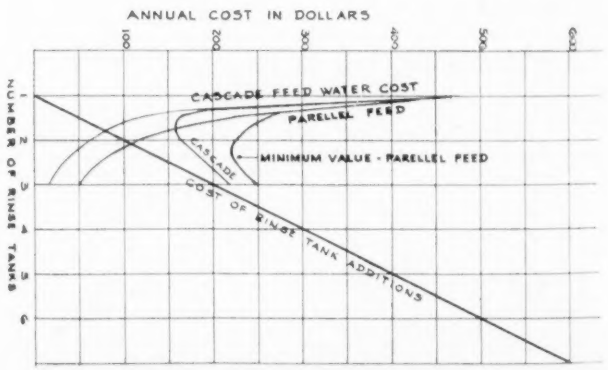


Figure 7. Optimum number of tanks and water flow for adequate Rinsing Criterion.

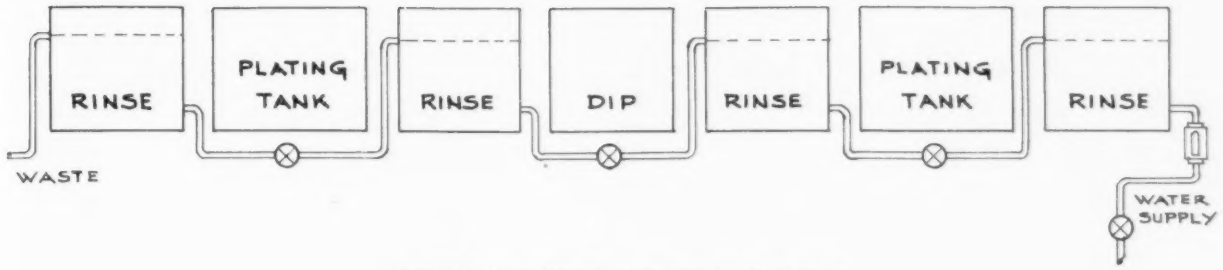


Figure 8. Long distance compartment rinse tanks.

Determination of the Optimum Rinsing Conditions

How can one decide on the number of compartments and the amount of water to use for a given rinsing operation? If the rinse tanks are individually fed with water, then the total amount of water used in a given rinsing operation is equal to $\frac{n\theta R^{1/n}}{p}$. The least amount of water will be used for the process if n, the number of rinse tanks used, is equal to the natural logarithm of the rinsing criterion, R. In most processes, R will vary from about 200 to 10,000, which calls for the use of from 5 to 9 tanks.

Such a large number of compartments or rinse tanks is usually out of the question except perhaps when the rinse compartments can be quite small, so another means must be found for approaching the optimum set up.

If we plot, as shown in Figure 8, the over-all annual cost of adding on a rinse tank to the system against the number of rinse tanks, and on the same coordinates plot the annual cost of water used against the number of rinse tanks, two curves result; 1) the rinse tank cost is essentially a straight line; 2) the other, the water cost, is of hyperbolic form. If both curves are added together and plotted, the sum of the two has a definite minimum value (usually close to the intersection point). This value gives the optimum number of tanks to use and the necessary amount of water flow required to maintain the desired rinsing criterion R.

To make this clear let us take an example. In a given rinsing process under consideration a rinsing criterion of 3000 is required. The average dragout per load of work as estimated from *Soderberg's* chart[8] given here, or as determined by one of the methods listed in the bibliography[9,10,11], is 0.1 gallon, and the interval between loads will be 2 minutes. The rinse tank volume is 50 gallons. What will be the optimum number of rinse tanks to use and the water flow, if the total cost annually of adding on an extra rinse tank (in terms of amortized value, space rental and production time loss) is $100, and deionized water costs .015 cents a gallon,* if the tanks are to be fed in cascade? In parallel?

First the straight line is plotted, then the water rate curve. One gallon per minute of deionized water at .01 cent per gal. costs annually $14.40 (on an 8 hr. day, 300 day year basis), so at .015 cents, the annual cost will be $21.50.

For 1 rinse tank, chart 7 cannot be used, so equation 6 is used which gives Q a value of 21.5 gpm. And the annual cost is $467.

With two or more effects, chart 7 can be used and this results in a series of values which are plotted in Figure 8. As can be seen, the optimum value for cascade feed is close to the integral value of 2 rinse tanks, as is also true with parallel feed. The total water flow for cascade feed will be about 2.7 gpm, and for parallel feed 5.4 gpm. For other cases, depending on the constants

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* *Deionized water costs vary from about .01 cent per gal. to .05 cent per gal., depending on raw water supply and chemical costs.*

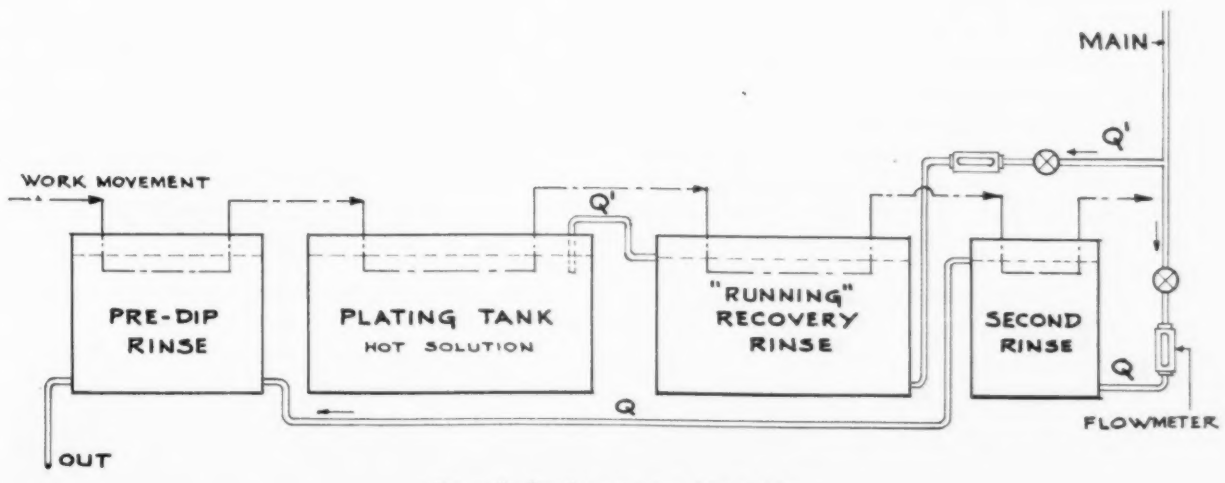

Figure 9. Running recovery rinse system.

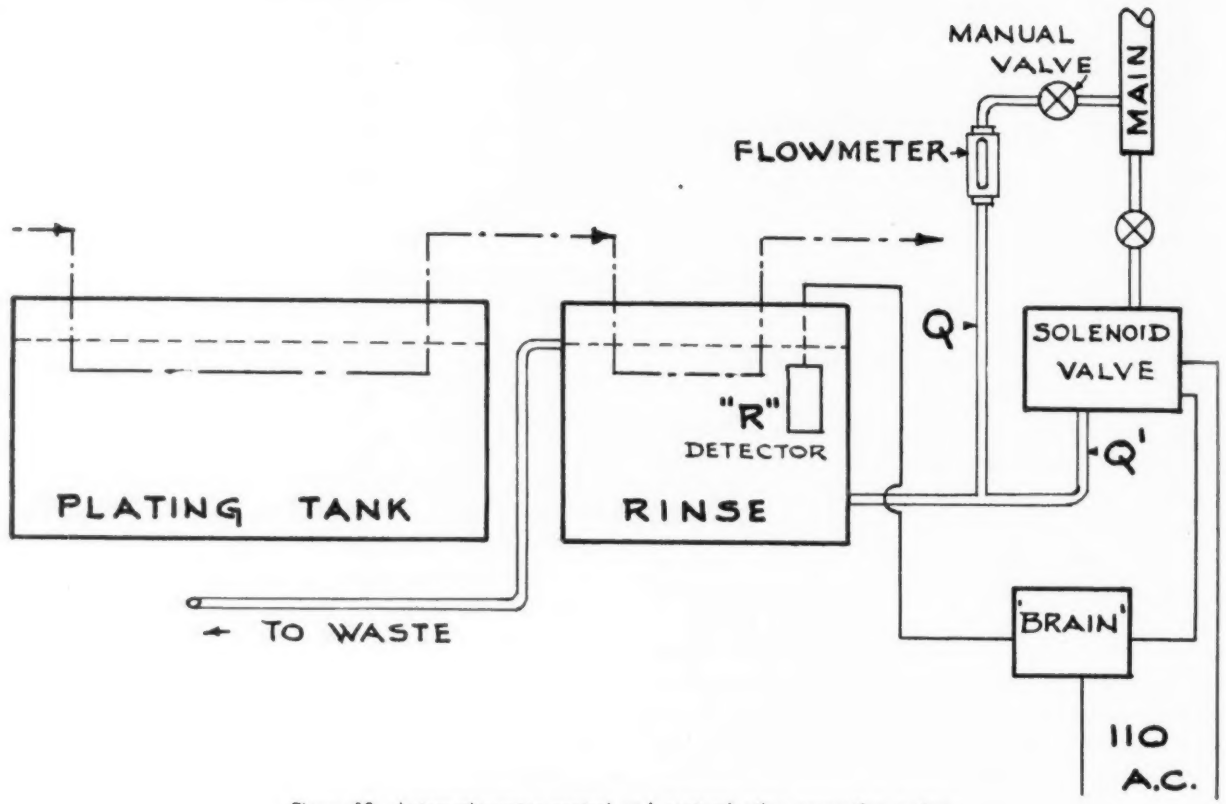

Figure 10. Automatic water control and contamination prevention system.

of the situation, the number of tanks may vary from 2 to 5, rarely more than this. It also will be noticed in plotting that the cost of the first tank is taken as 0 because it is a necessary part of the plating process and its cost must be charged to that.

The Possibilities of Water Control

There are many ramifications to water control which, as far as the plating industry is concerned, open up a completely new line of thought. Thus for example, consider a series of plating tanks and rinses in a given cycle. It is possible, as shown in Figure 9, to connect 2 or more of the rinse tanks in series, using a drop in level of a few inches, as "long distance" compartment rinse tanks and thus cut down on the total water bill tremendously!

It is possible to use "running" recovery rinse tanks for returning a good part of the material lost by drag-out from a tank, as shown in Figure 10. It is possible to equip job shop rinse tanks where greatly differing loads may be expected, with a system such as illustrated in Figure 11, in which water flows at an absolute minimum rate to take care of "average loads" but the moment heavy loading takes place, the conductivity tester signals a lowering of R below the critical level which in turn opens up the solenoid gate valve to permit an extra flow of water so that R may be maintained in spite of the more frequent and greater loading. It is possible to feed back deionized water that has been used for rinsing, back to the deionizer to lower the water cost. These are just a few of the many things that can be done with water control.

The Advantages of Water Control

1) *Water Control in the plating room will definitely lower water bills,* which in many areas are a considerable overhead item. While there will be some initial expense involved in installing control devices such as rotameters and valves, there can be no doubt that this equipment will soon pay for itself in lowered water costs.

2) *Water Control in the plating room makes possible the economical use of deionized water throughout,* for both the plating baths and the rinse tanks. The advantages of using deionized water in plating are well known. Hitherto plating plants have been chary of using it for rinsing purposes because of the element of cost. It can be safely said that with proper engineering most plating plants using raw water can be converted to the full use of deionized water, under water control, so that the deionized water bills are no greater or only little more than their present raw water bills!

3) *Water control in the plating room will definitely help minimize the problem of plating room wastes.* A great deal of attention has been brought to bear on the treatment of plating plant wastes in the past two years. The handwriting is on the wall and there can be no doubt that at some time in the not too distant future *all plating plants will be required to detoxify* their wastes before dumping them down the sewer. It makes common sense that the smaller the volume of waste liquid, the easier and less expensive it will be to handle. Water control can make possible a reduction in waste waters of up to 90%!

Literally speaking, water control in the plating room opens up a new world to those who plan and do plating operations. It is this writer's prediction that as good water becomes more and more scarce—which it is—

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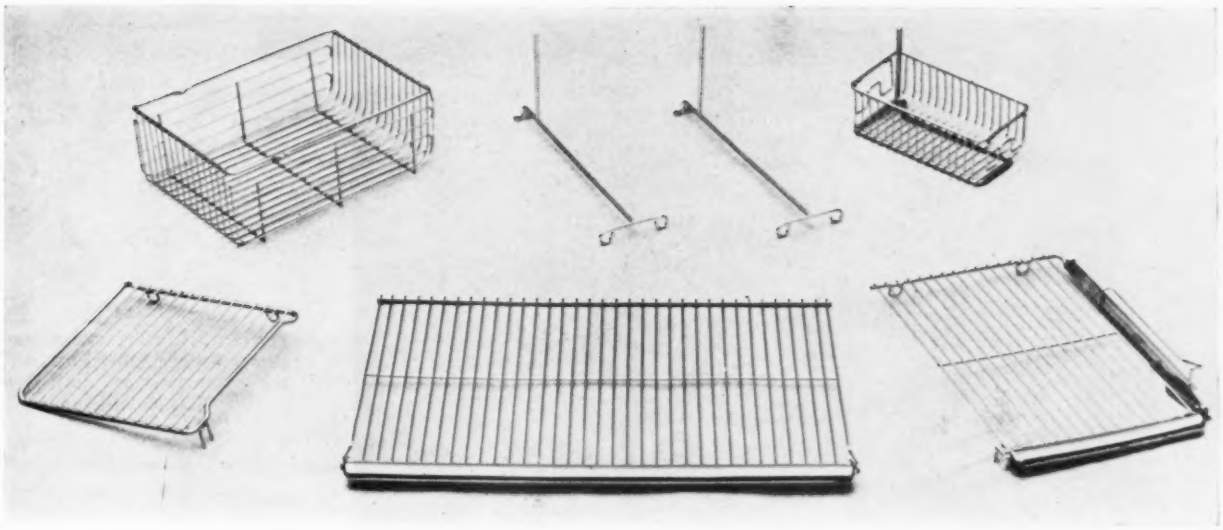

Electro-Polishing of Refrigerator Shelves

By **D. Chieger**, *Metallurgist, L. A. Young Spring & Wire Co., Detroit, Mich.*

THE development of the electrolytic method of polishing stainless steel was the number one factor in making stainless steel refrigerator shelves a possibility on large scale production. One of the first two installations, a semi-automatic type of 2800 gallons solution capacity, was put in operation at *L. A. Young Spring & Wire Corp.* Plant #2, in the early part of 1938. Last year our electro-polishing capacity was increased 60% with another semi-automatic unit of 2000 gallon capacity. Both of these units are used only for electro-polishing stainless steel refrigerator shelves and no other purpose, giving L. A. Young the largest productive capacity in this country for electro-polishing refrigerator shelves.

The Author

Mr. Chieger is a graduate of Detroit Univ. in Chemical Engineering He was connected with the Detroit Transmission Div. and the Aeronautical Products Corp. as metallurgist before joining the L. A. Young Spring and Wire. Co. in 1942, *where he is in charge of finishing and laboratory operations for all their plants.*

Previous to 1938, all shelves were made of low-carbon steel wire, either hot-tin dipped or plated to aid wear and prevent rust and corrosion. Stainless steel was the better material for the job, but polishing and buffing as well as the high cost of stainless made overall costs too high. With production electro-polishing, where costs are less than the plating costs for low-carbon wire shelves, the increased overall costs are mainly due to higher raw material costs.

Electro-polishing, which is the reverse of electro-plating, lends itself very readily to the brightening of stainless refrigerator shelves. The mechanism of electro-polishing removes metal from the high spots, and therefore will do a considerable amount of deburring in places inaccessible to a polishing wheel. Gas pockets are few and contact marks can always be made to appear in places not easily noticeable. Since electro-polishing passivates the surface, the corrosion resistance of an electro-polished shelf is greater than that of a mechanically polished shelf.

Cleaning Before Polishing

Generally, very little pre-treatment is necessary, but a clean shelf can be polished quicker and brighter. If the part is made using only sheet and strip steel, a simple degreasing operation will be sufficient. When cold-drawn wire is used the cleaner must remove either drawing compound, lime, or in some cases

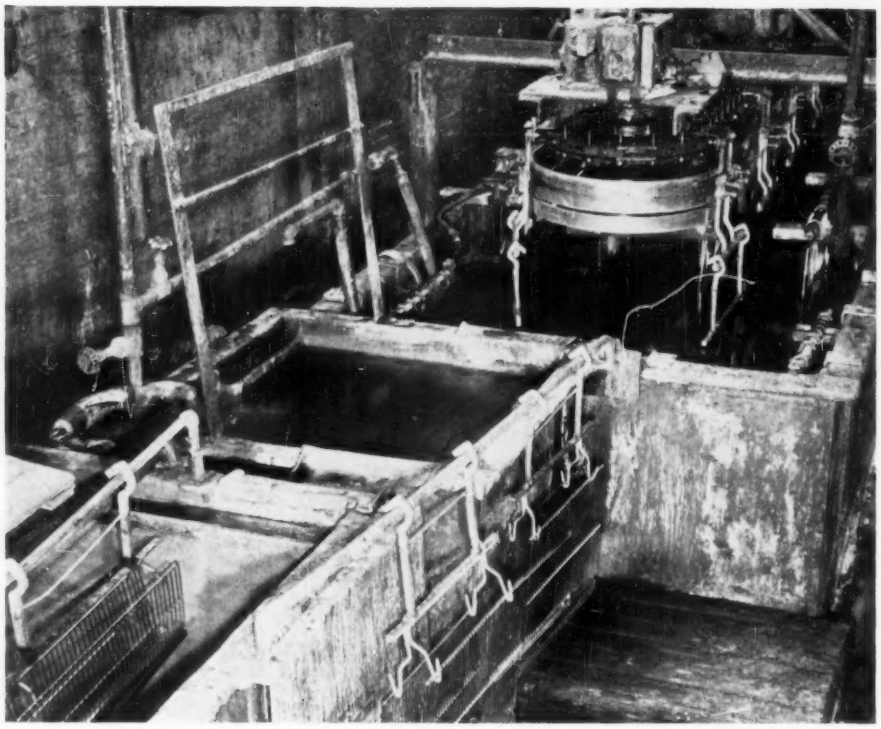

Figure 1. Loading and unloading station for the Citric-Sulfuric electro-polishing set-up. Reclaim rinse at left.

traces of lead. In a fully automatic system, an electro-cleaner will do the best job, but otherwise an emulsion cleaner "spiked" with an alkali is the most efficient cleaner to use. Any traces of foreign matter on the parts to be electro-polished will cause a secondary cathode action to take place, and the metal will be badly etched underneath this foreign matter until it is removed and actual polishing is done at that spot.

Electro-polishing

In our largest installation, semi-automatic type, we use a citric-sulfuric solution* in a lead lined tank. Current is supplied by two 6-12 volt, 7,500 ampere generators. Two rows of copper cathodes are used, with the work as the anode being suspended between them and moving with friction contact. The rows of cathodes are about 18 inches apart, and are never moved; the amperage is adjusted by a change in voltage with the varying type of work.

The proper balance for a well worked bath with a high concentration of metal salts should have 37-40% by weight of citric acid and 28-30% by weight of

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* *Lisensed from The Rustless Iron & Steel Div. of Armco Steel Corp.*

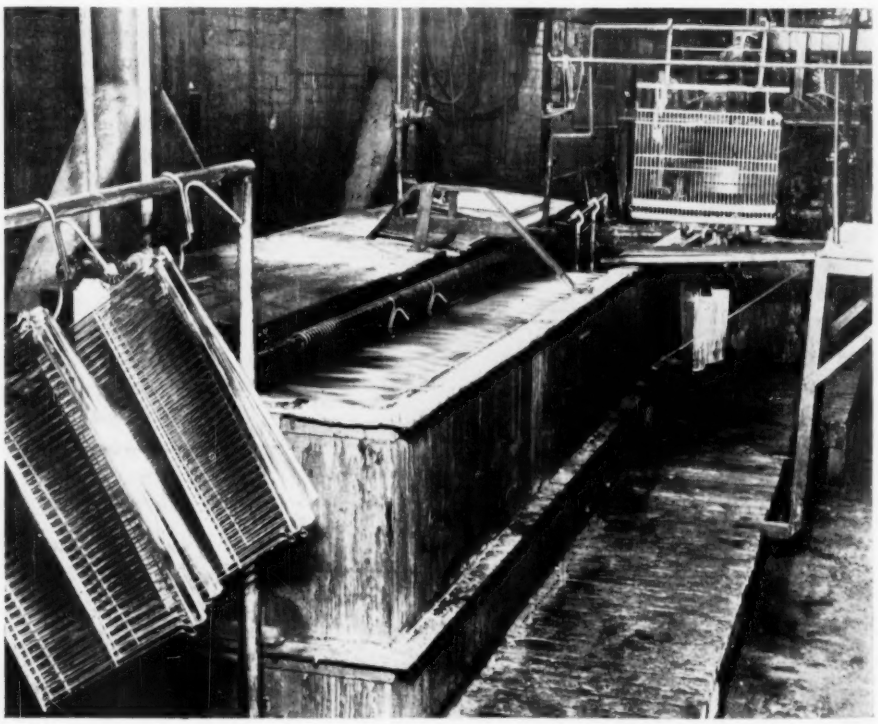

Figure 2. After reclaim rinse, parts are put through a final rinse on a screw-type conveyor (in tank). A spray gives the parts a final washing off. Note racking arrangement in upper right.

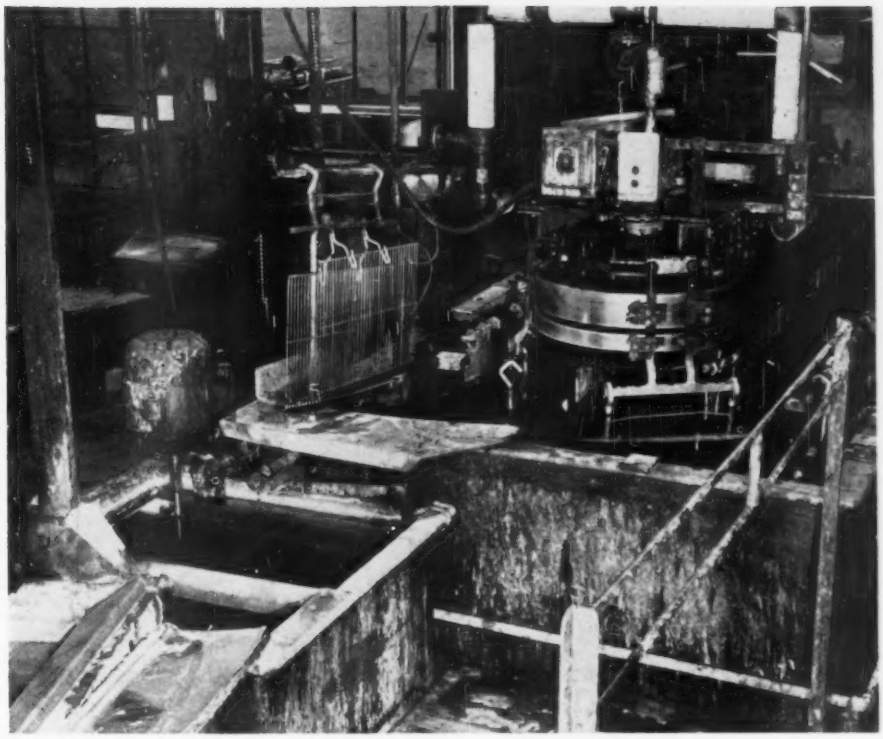

Figure 3. Load end of glycolic electro-polishing machine. Rinses are on the left side.

sulfuric acid. This solution will polish both Type 302 and Type 430 stainless steel in the same time cycle to the same mirror brightness, even when both types are mixed on the same shelf. It has very good throwing power and will remove about .001" from a wire diameter in 7 minutes, with a current density of one ampere per square inch. Temperature of the solution must be maintained between 180° and 200° F. to obtain good conductivity and untarnished work. A cold bath is heated to operating temperature by means of steam coils, which can be used as cooling coils by a special valve arrangement. When running heavy production, the bath will tend to run hot and impart a distinct, objectionable brownish cast to the polished surfaces. The constant addition of cold water to replace the amount of water evaporated will help to maintain a temperature below 200° F. The cycle or treatment time is seven minutes. On a production basis this will allow about 175 racks per hour.

If the temperature continues to rise gradually, the amperage must be lowered by switching to shelves which have less exposed area per rack.

Racking Method

Contacts on the racks are made with square copper

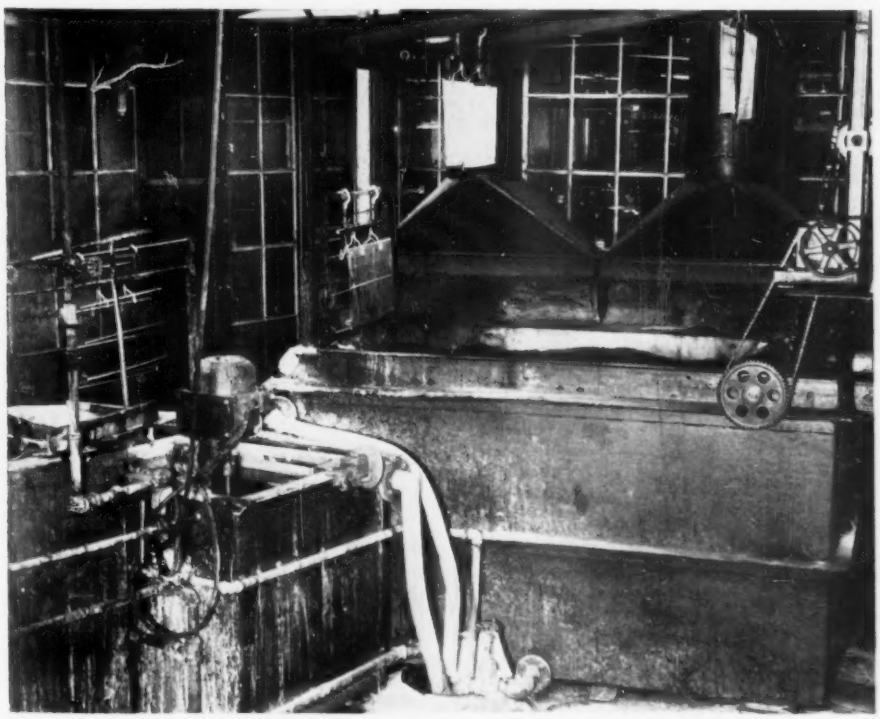

Figure 4. A different style of conveyorized rinse is used on the glycolic polisher after the reclaim rinse.

pinch-type V to prevent "burning," which will cause hook marking on shelves drawing over 100 amperes per contact. These racks, of which twenty-four are in the bath at a time, are designed to carry two large shelves about three inches apart between two rows of cathodes which are about 18 inches apart. Half-shelves with or without slide section for meat trays are done four on a rack, and quarter or side shelves six on a rack. Full size basket-type of wide sliding shelves are done one per rack, and baskets are done two or three at a time depending on size.

Production Problems

Maintaining this short polishing cycle becomes the major production problem, and careful control must be exercised on the quality of the raw material. The original surface must be as free of hot roll lines, scratches, straightener marks, rolling marks, intergranular carbides, annealing skin, pickling pits, etc. as possible. Type 302, as used in refrigerator shelves, is annealed and drawn only one pass, and, if annealed improperly, will have a tendency to be "frosty" after a seven minute polish and will require additional treatment time to make passable. This difficulty on coarse size wire, .192" and over, was overcome by the Allegheny-Ludlum Steel Corp., who have a special process for removing this annealed skin (about .004") from the wire diameter. Since this special process is the last operation on the wire, it removes all traces of lime, drawing compound and hot rolling defects. Without this skin the wire will polish to mirror brightness in about three minutes, and this material is used on all coarse wire by our company. The fine size wire has been bettered by special annealing and drawing practices at various wire mills. All coils of raw material are checked before use for polishability in our seven minute cycle. Our specifications call for electro-polishing quality on all materials purchased for refrigerator shelves.

The second major production problem is the use of a universal work carrier (rack) for some ninety different stainless shelves produced. We maintain three different sets of work carriers to handle large, half and quarter shelves, and interchange from one to another with very little loss of production.

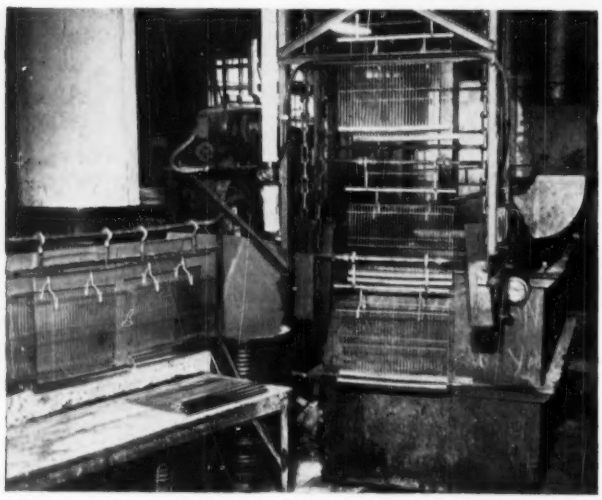

Figure 5. Discharge end of conveyorized rinse on the glycolic polisher.

Rinsing

The citric-sulfuric solution is the freest rinsing solution of any commercial type in use. We use one lead-lined reclaim rinse tank and a hot water final rinse. This last rinse (as shown in the photograph) has a screw arrangement for moving approximately half a dozen shelves on each hook along to the end of the tank. The time in this last rinse should be as long as possible and will prevent spotting and electro-polising solution leakages from the folded-over sections. The reclaim rinse tank is kept hot by the overflow from the final rinse, which is heated by an open steam line.

Glycolic Polishing Bath

In our other installation we use a glycolic type solution in a lead-lined 2000 gallon capacity tank (shown in photograph). The current is supplied by a "bank" of 12 volt rectifiers, with cathode and rack arrangement very similar to the citric installation. More control is necessary to keep this bath functioning productively. Temperature, anode to cathode distance, cleanliness of cathodes and analysis of solution are each critical factors in maintaining proper amperage to obtain the desired grade of polish in a seven-minute cycle.

The bath analysis best suited for both Type 302 and Type 430 stainless steel polishing is as follows:

Phosphoric Acid	15-20%
Sulfuric Acid	30 %
Glycolic Acid	30 %
Water	15-20%

The temperature must be maintained between 180°-200° F., and this is done by means of coils that are interchangeable to steam and cold water. Lower temperatures cause a rapid drop in amperage due to increased solution resistance. Cathodes tend to "cake-up" and must be cleaned once every 48 operating hours. Anode to cathode distance must be as short as possible and changed with various shelves by means of a sliding support arrangement. This solution is much harder to rinse due to the tendency of white phosphates to form on the surface of the shelf, especially with high phosphoric acid content. This was counteracted by rinsing first in lukewarm water (used as water addition to bath when required) and then dipped in warm 20% nitric acid solution and finally rinsed in hot water (shown in photograph).

The glycolic type of solution has a number of advantages over the citric type solution; namely,

(a) wider polishing range, from one-half to five amperes per square inch compared to one-half to two amperes.
(b) faster metal removal under identical conditions.
(c) less sludging.
(d) shorter polishing cycle.
(e) brighter polishing, especially when only Type 302 stainless is used.

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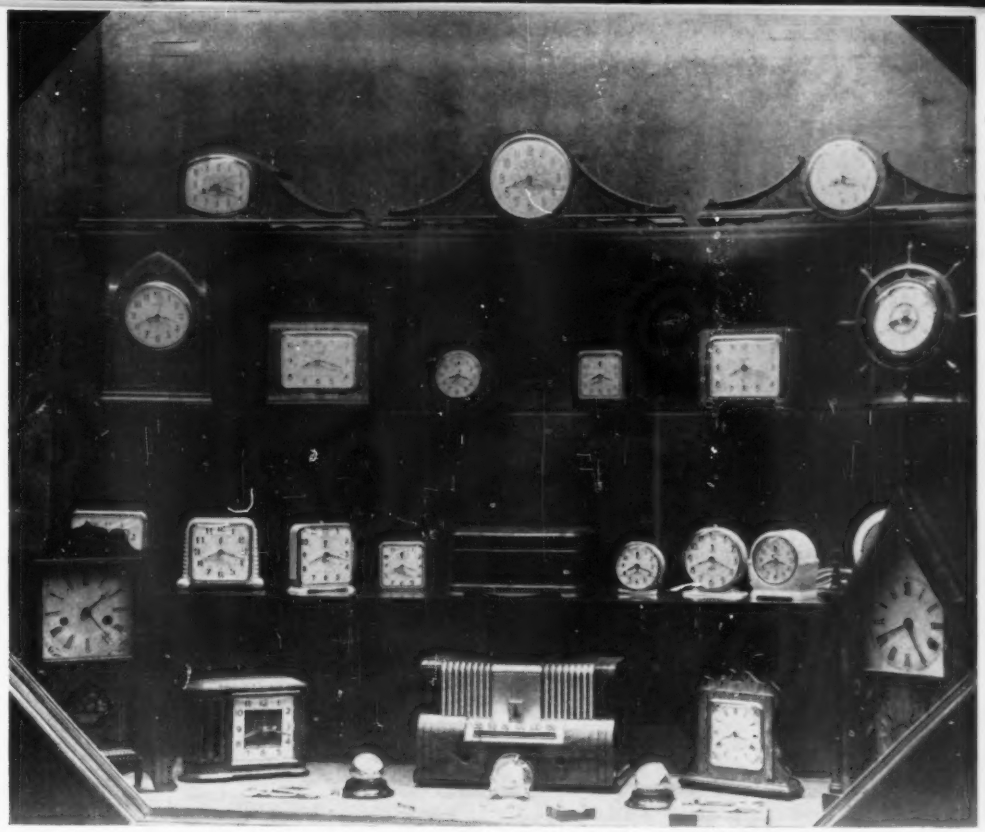

Clocks and watches by Ingraham.

Automatic Plating at the E. Ingraham Co.

By W. A. Raymond, *Engineering Editor*

Figure 1. Entrance to the Ingraham plant, which covers 600,000 sq. ft. and employs 2,400 people in Bristol, Conn.

THE chances are that nearly every man, woman, or child in the United States has at some time in their life come in contact with the products of one of New England's oldest industries, *The E. Ingraham Co.*, of Bristol, Conn., for the dependability of their products, plus approximately 200,000,000 units that have been produced, have literally made their line of watches, clocks, and timers a "watchword" in the American household of today.

Strangely enough, the company was originally founded in 1831 as a cabinet making and woodworking shop, manufacturing furniture, mirrors, coffins, and incidentally, fine clockcases. In 1841 the manufacture of pendulum clocks was started and about 1890 the firm first began to manufacture 30 hour alarm clocks, following this later with a complete line of pocket and wrist watches, electric clocks, and industrial timers and control devices. As a result of their continued devotion to the task of making superior products, the Ingraham Co. can boast of a long line of "firsts" in their industry.

The company is presently managed by direct descendants of the founder, and today has a production capacity of well over 30,000 clocks and watches daily, plus a substantial number of wooden clockcases, radio and television cabinets, and specialty woodworking items, and is recognized throughout the world as one of the leaders and pioneers in the industry.

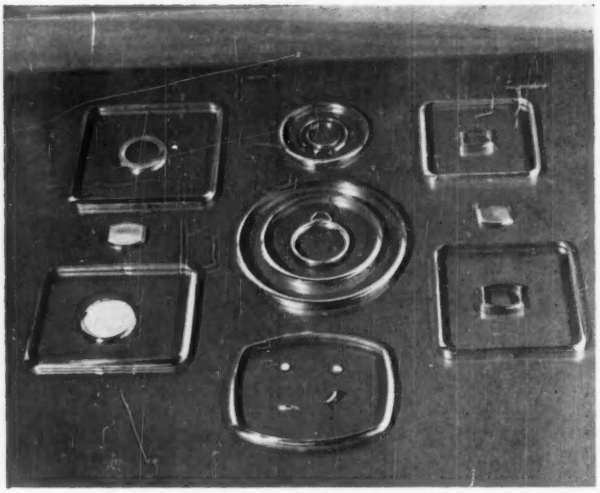

Figure II. Showing the range of clock and watch parts handled on the automatic plating line.

might be made of either steel, brass, or nickel silver, and the desired final finish might be brass, nickel, or chrome.

Automatic Plating Machine

After considerable engineering study, a completely automatic plating machine was installed about a year ago. Figure III is a schematic diagram of the various steps through which the parts are conducted. This machine has operated with complete satisfaction, and currently is producing highest quality plated parts at the rate of 3,240 to 16,200 pieces per hour, depending on the particular parts being plated.

This plating machine is unique in several ways:

1. It permits a completely automatic cycling of parts through a nickel-chrome plating sequence without having to unrack parts between plating operations.

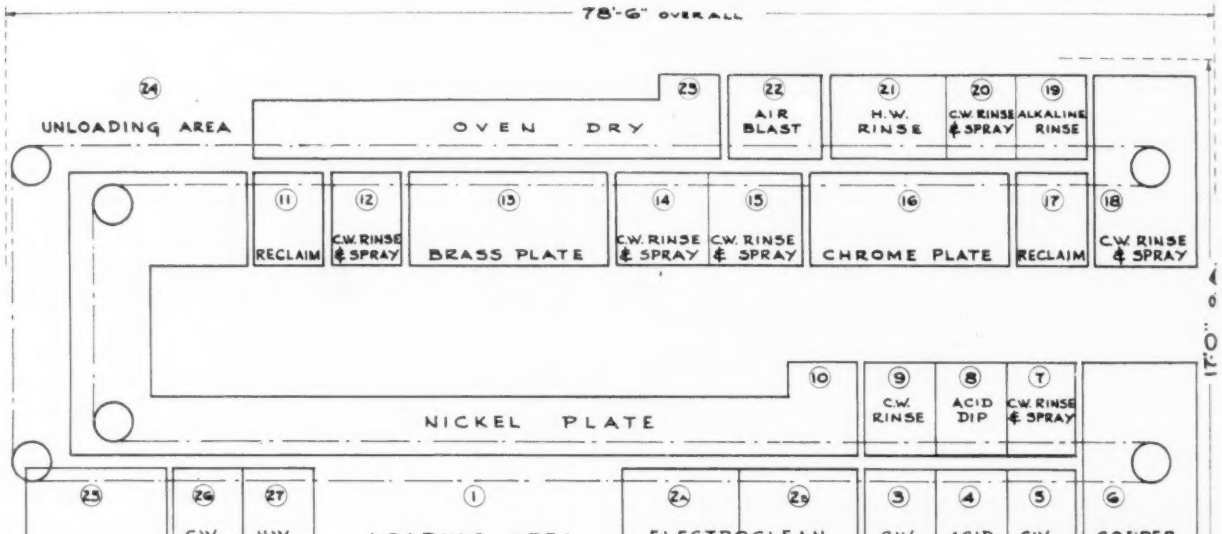

Figure III. Schematic layout of the automatic plating cycle.

With the reconversion to their normal manufacturing procedures from the war-time manufacture of delayed time fuses and anti-aircraft fuse parts, the Ingraham management was faced with the problem of providing adequate production facilities for the enormous pent-up demand for their products throughout the world, and one of the worst production "botlenecks" that had to be eliminated was in the plating department, which, while up-to-date and reasonably efficient, could not even approach the high production quotas which it was being called upon to meet. After a detailed study of production requirements, it was decided that only a completely automatic plating system would enable them to maintain the required work output of the necessary plated parts, which were principally alarm clock bezels, pocket watch backs, bezels, and centerbands (with crossbar and bows), and wrist watch bezels and backs. Smaller items that also required plating were the winding knobs and keys of various sizes and shapes. (See Figure II.) A complicating factor was presented by the fact that these parts

2. Its flexibility permits the production of a bright nickel, bright brass, or bright chrome finish on any one of the three base metals employed.

Figure IV. Loading parts onto the plating conveyor line.

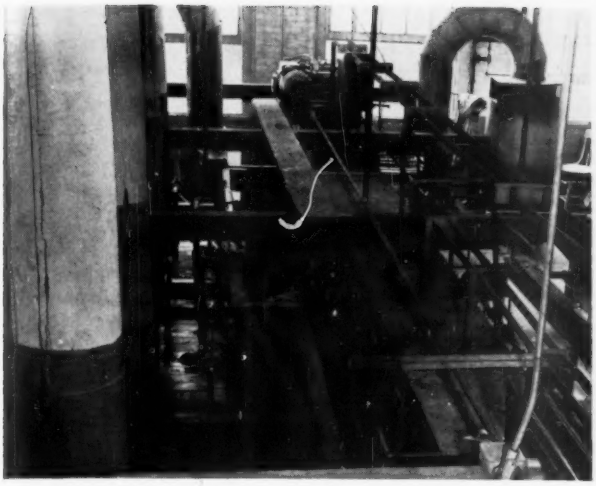

Figure V. View of entrance into bright nickel tank.

The sequence of operations performed automatically is as follows:

	Operation	Cycle Time
1.	Alkaline clean (direct current)	30 seconds
2.	Alkaline clean (reverse current)	30 seconds
3.	Cold water rinse	
4.	Dip in 5% sulfuric acid	
5.	Cold water rinse	
6.	Strike in a cyanide copper bath	30 seconds
7.	Cold water rinse, with spray rinse	
8.	Dip in 5% sulfuric acid	
9.	Cold water rinse	
10.	Bright nickel plate	4 minutes
11.	Nickel reclaim rinse	
12.	Cold water rinse, with spray rinse	
13.	Brass plate (optional)	45 seconds
14.	Cold water rinse and spray	
15.	Cold water rinse and spray	
16.	Chrome plate (optional)	70 seconds
17.	Chrome reclaim rinse	
18.	Cold water rinse and spray	
19.	Alkaline rinse to neutralize chromic acid	
20.	Cold water rinse and spray	
21.	Hot water rinse	
22.	Cold air blowoff	
23.	Hot air blast drying in tunnel	2¼ minutes
24.	Unload finished parts	
25.	Strip chrome, nickel, etc., from racks and contacts	
26.	Cold water rinse	
27.	Hot water rinse	

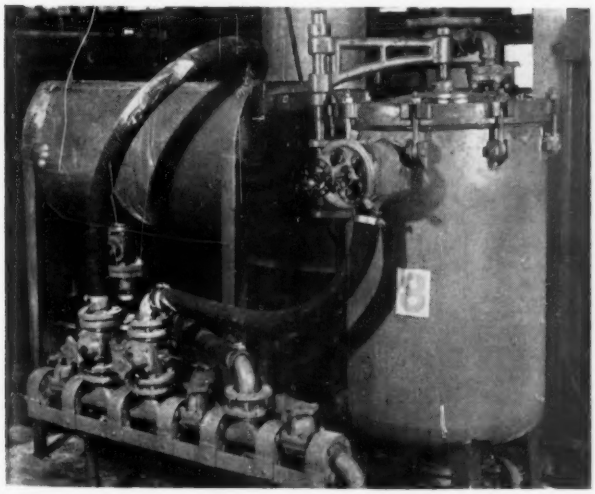

Figure VI. Nickel filtration arrangement, showing by-pass valving and slurry tank.

The brass plating tank and the chrome plating tank can both be by-passed as production requires, but all work, regardless of the base metal, is given the copper strike-bright nickel treatment.

An important factor in the success of this machine was the working out of suitable alkaline cleaners and a cleaning cycle which would work equally well on the various base metals employed. These cleaners operate at 150° F., with automatic temperature control on each tank.

The cyanide copper strike is a conventional low copper concentration bath, operated at room temperature. Means are provided for keeping this solution hot, if desired.

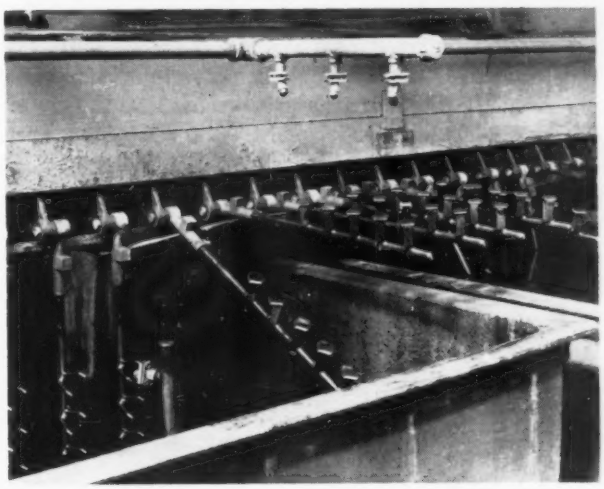

Figure VII. Transfer mechanism, showing simplified racks and rack fastening arrangements.

The 1,600 gallon nickel bath is a proprietary organic bright nickel, and utilizes continuous filtration for maintaining bath cleanliness, with an external heat exchanger and pump for maintaining the desired 140° F. operating temperature. The rate of solution turnover by the filter is approximately once every 1½ hours.

Originally the nickel bath was given a carbon purification treatment only when it seemed advisable from the appearance of the plated parts, but a regular schedule of purification is now used to prevent trouble from undesirable organic impurities. In the first few months of operation it was found that some contamination of the bath was coming from the grease fittings on the pumps used for circulation through the filter and heat exchanger. These have now been changed to a water lubrication type.

The reclaim rinse after the nickel plating operation, as well as the reclaim rinse after the chrome tank, is electronically controlled to pump reclaim solution into the main plating tank whenever the plating solution

Figure VIII. Racking small parts separately. Complete rack is then inserted in plating conveyor by regular loading crew.

levels fall below pre-determined heights. This automatic control also pumps new water into the reclaim rinse as required.

Brass plating is done for color purposes only, the very light plate deposited in the 45 second cycle coming from the plating bath in a bright condition, due to the bright nickel under-plate. All brass plated ware is finally coated with clear lacquer. The brass solution used is a conventional room temperature bath, using ball anodes.

The chrome plating tank, of 750 gallons capacity, can also be by-passed when brass or bright nickel finishes are desired. A 33 oz/gal chromic acid solution is used, in order to minimize dragout losses. A reclaim rinse with completely automatic controls, similar to that following the bright nickel tank, follows the chrome tank.

After rinsing and neutralizing any chromic acid in a ½ oz/gal bath of the regular alkaline cleaner, the parts go through a drying tunnel, where a cold air blast forces off most of the water clinging to the parts, then a steam-heated air blast completely dries the parts. No cooling period is required, as the very light nature of the parts enables them to lose heat with sufficient rapidity to permit comfortable handling by the unloading crew.

After the racks have been emptied, the conveyor carries them through a stripping cycle which removes any chromium, nickel, brass, or copper from the contact tips. This treatment is a reverse current de-plating in a 5% solution of hydrochloric acid, conducted in a rubber-lined tank, using lead cathodes. After stripping, the racks are cold and hot rinsed, then are ready for a new load of parts.

Racking Methods

One of the important features of Ingraham's automatic plating unit is the ease of changing racks when a production change-over to another type part is called for. The entire rack spline is completely removable from the conveyor by a simple loosening of a hexnut (See Figure VII). For certain very small parts, such as watch winding knobs, where the speed of the conveyor is too rapid to permit loading the racks by the usual loading crew, the racks are loaded at a separate bench (Figure VIII) and the entire rack slipped into position on the conveyor and held in place by a pin. As many as 216 of these parts may go on a single rack. The firm makes, coats, and repairs all its own racks, using a plastisol type coating.

Auxiliary Equipment

Power is supplied from a group of selenium type rectifiers which are mounted overhead in a clean, well-ventilated balcony (See Figure IX). The control cabinets for these rectifiers are mounted in a convenient bank at the operating floor (Figure X). The rectifiers are rated as follows:

Direct Current Electroclean	300 amps- 6 volts
Reverse Current Electroclean and Copper Strike	500 amps-12 volts
Nickel Plating	4000 amps- 6 volts
Brass Plating	300 amps- 6 volts
Chrome Plating	2500 amps- 6 volts

Fume separators are installed wherever required to maintain proper ventilation. Those on the chrome plating and chrome stripping baths, both of which give off highly acid fumes, are constructed entirely of stainless steel.

Control Methods

All solutions are under the control of the plating chemist, who uses Hull cell tests and frequent chemical analyses to keep the baths in good order. A schedule of daily additions to each tank has been worked out, the results being checked by a weekly analysis for all important constituents. Plating thickness, brightness, and other plate characteristics are also watched closely. Setting of the power controls for each tank is also performed by the control chemist.

Related Operations

Wheel (buffing) operations preparatory to plating are held at a minimum for all the parts shown, a two wheel operation involving cutting and coloring sequences being all that is required. These operations

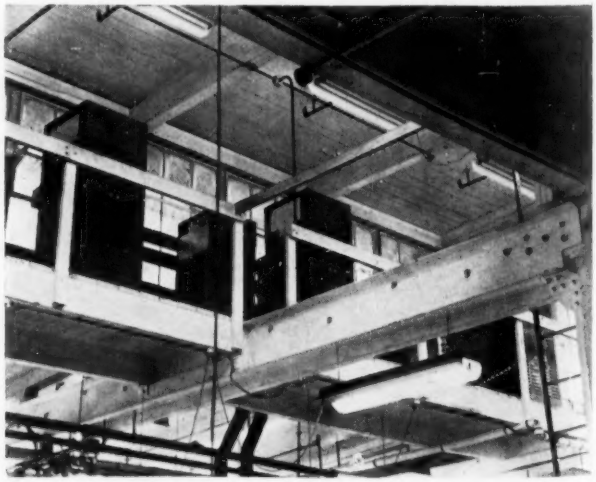

Figure IX. Rectifiers are mounted overhead, away from solutions and fumes, in light, well ventilated balcony.

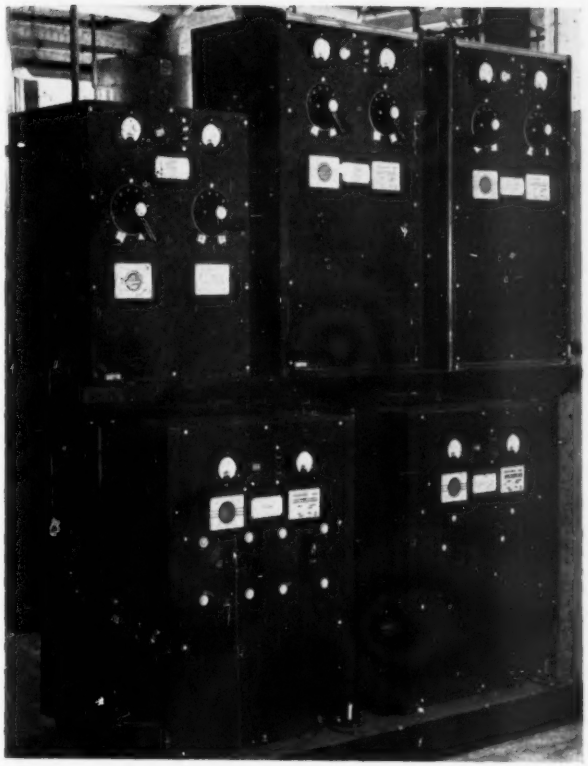

Figure X. Power controls are mounted in a convenient bank in the center of the operating floor.

are performed in a separate department on standard type lathes.

In addition to their automatic plating, line, Ingraham also runs a separate plating department where specialized operations and finishes on many miscellaneous parts are produced. In this department are barrel tin, barrel brass, barrel nickel, cadmium, gold, and silver plating set-ups, as well as a line of tumbling and burnishing machines.

The increase in production, the superior quality and uniformity of the finishes produced, and the lower over-all production costs have convinced the Ingraham management that the capital expenditure for their automatic plating line was completely justified.

ALL OUR YESTERDAYS

(*Concluded from page* 51)

The difficulty is caused not by the vinegar but by zinc from the galvanized iron. You cannot remove it by chemical methods except at large expense, but it may work out if run for some time, although it may be necessary to throw it out and make it up anew.

Q: While I was away one of our large nickel tanks sprang a leak. During the relining of the tank they placed the solution in machine-oil barrels which had not been washed out. Can anything be done? (The answer is too long to quote: but in brief, be more careful in future.)

I always like simple, direct answers:

Q: My acid copper solution has turned green.

A: You have put something green in it.

Other questions indicate that a satisfactory method for stripping nickel from steel had not yet been developed; that in nickel-plating springs they "crystallize and break." The editor remarked that "You are not alone in having trouble over the plating of spring wire. I would suggest you use a very weak current and leave the goods in the bath no longer than necessary to get a fair deposit. The current is the chief factor in producing the crystallization."

On July 29 the Cape Cod Canal was opened to traffic, reducing the trip from New York to Boston by 70 miles; and on August 15 the Panama Canal was opened, but closed again a month later by slides in the Culebra Cut; again on October 15 and 31 the Culebra slides bottled up the Canal. On August 6 Mrs. Woodrow Wilson died at the White House. In the November elections the Republicans made large gains in the House and reduced the Democratic majority to negligible proportions. But overshadowing all this news, of course, was the reverberation of an assassin's bullet at Sarajevo on June 28. After a month of ultimata, notes, and mobilizations, on July 28 Austria-Hungary declared war on Serbia and World War I had begun. Choosing up sides for the grim game continued on through August, as different countries made detailed declarations of war. On August 4 President Wilson proclaimed our neutrality, and continued to issue neutrality proclamations following each fresh declaration of war in Europe.

As the war progressed, our State Department was kept busy protesting violations of our neutral rights and of international law by both sides. So in a cloud of doubt at home and horror abroad the year ended.

WHERE DO WE GO FROM HERE?

(*Concluded from page* 58)

more and more attention is going to be paid to water control in the plating room.

This necessarily short paper has presented only a few of the basic principles. There are many, many fascinating possibilities in this field which have yet to be explored and it is this writer's intention to cover some of these points in future papers.

DRAGOUT TABLE (According to Soderberg[8])

Description of Parts	Dragout in Gallons per Sq. Ft. of Surface
Vertical, well drained	.0004
Vertical, poorly drained	.002
Vertical, very poorly drained	.004
Horizontal, well drained	.0008
Horizontal, very poorly drained	.010
Cup shape, very poorly drained	.024

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Blastcleaning Stainless Steel Castings

By Herbert Gibbs, *Finishing Foreman, The Cooper Alloy Foundry Co., Hillside, N. J.*

KEEPING pace with a foundry whose production capacity exceeds a million pounds of stainless steel, nickel and Monel castings per month is no easy task, and the job of a finishing foreman can very easily become the stepping stone to the nearest rest home. The *Cooper Alloy Foundry Co.* is one of the world's largest foundries devoted exclusively to the casting of these high alloys. Their output consists of castings of all sizes, from small units weighing only a few ounces all the way up to engineered castings weighing well over a ton.

Accurate planning of work flow is essential if handling is to be minimized and maximum production efficiency achieved. The material must be directed to the unit which can do the job most effectively, and the equipment must be so placed as to cut down distances required for handling. In selecting the equipment to be used, consideration must be given to variations in the size, weight and quantity of the parts being handled.

Basic to our operations are four types of blasting units:

1. Enclosed cabinet air blast type . . . used for precision work and for small parts requiring individual handling.

Fig. 1 (above). Air blasting small precision parts in cabinet-type unit. Very fine sand is used to insure maintenance of close tolerances for precision blanking operations that follow.

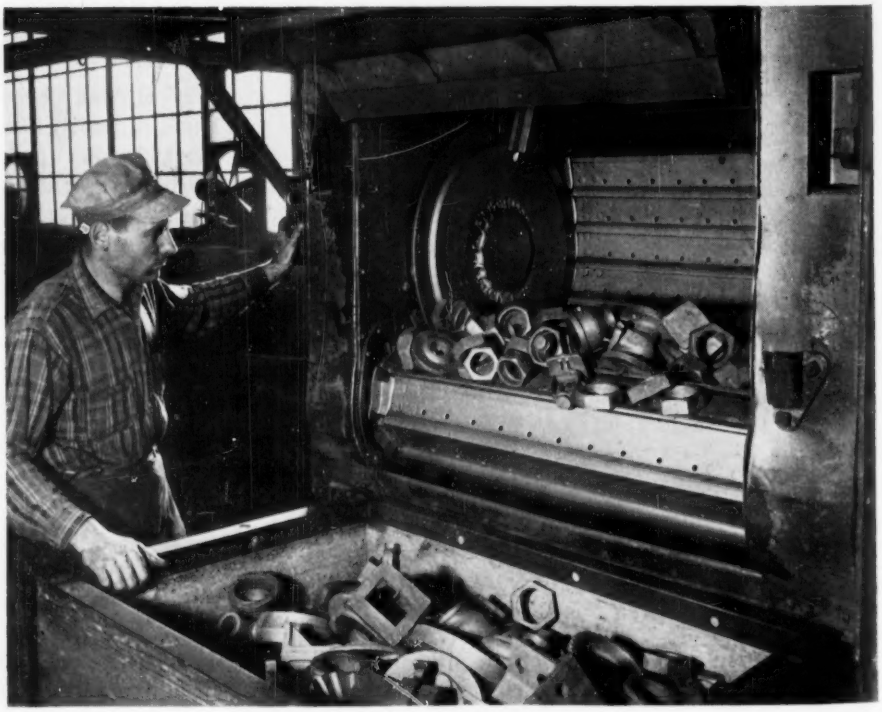
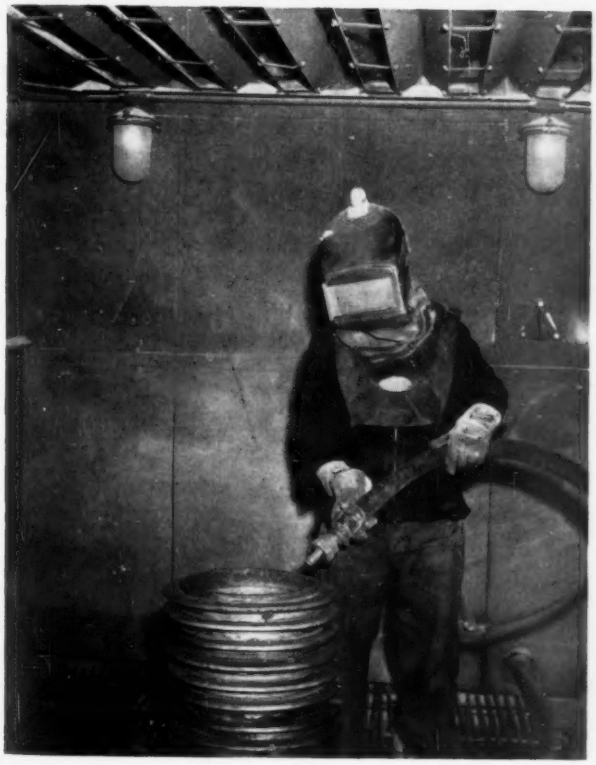


Fig. 2 (at right). Mechanical blasting with shot propelled by centrifugal force in this machine cleans 1500 lbs. of stainless castings in a single load.

(At right). Rotating table top units are excellent for blasting engine rings and similar flat surface parts. The shot is forced against casting by centrifuging action.

(Below). The "man from Mars" blast cleaning large castings.



2. Modern tumbling barrel . . . designed for mass production work where parts are relatively small in size.
3. Rotating table . . . especially valuable for flat surface castings requiring hard, uniform blasting.
4. Sandblast room . . . using standard air hoses; these rooms are essential to the blasting of all large castings.

Sand, steel shot and stainless steel shot are all used, depending upon the nature of the part to be blasted and the type of equipment being used. A recent development, patented by The Cooper Alloy Foundry Co. covers the use of stainless steel shot for the blasting of stainless steel castings. Although it is till in the experimental stage, we have already seen sufficient proof of its value to predict that one day it will be an important tool in the finishing department.

ELECTRO-POLISHING OF REFRIGERATOR SHELVES

(*Concluded from page* 62)

Noticeable disadvantages of the glycolic bath are as follows:

(a) poor rinsing.
(b) varying amperages caused by evaporation of water and "caking" of cathodes.
(c) requires tighter contacts to prevent hook marking.

Naturally, with the formation of metal salts in any electropolishing solution, it becomes necessary to remove sludge formation from the bottom of the tank. This is done about once in every 150 operating hours. Foaming caused by the high current density is easily controlled with any one of a number of anti-foam agents.

Summary

In order to maintain a continuous flow of production of refrigerator shelves through the electro-polishing operation, the following factors assume the most importance:

1. Solution analysis control.
2. Maintaining proper amperage on a definite work area being electro-polished by knowing which factor is easiest to change to meet requirements.
3. Good electrical contact of shelf to work carrier; weight alone is not enough.
4. Thorough rinsing and as long as possible.
5. Raw material control—polishability of all material in a predetermined setup of constant conditions, such as passable appearance after a definite amount of material removal in an electropolishing bath.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Spotting Out of Plated Castings

Question: We are experiencing difficulty with spotting out of our lead ornamental castings. We have tried a dilute acid dip after plating, without much success. Can you suggest anything to overcome this difficulty with our brass and copper plating?

C. A. W.

Answer: Spotting out of castings, whether of lead or any other base metal, is probably the oldest problem in the plating industry and is caused by the trapping of processing chemicals in any fine pores, cracks, or crevices in the surface of the castings. To eliminate spotting out these absorbed chemicals must be completely eliminated. It is fundamentally a rinsing problem, although thorough rinsing in water does not always clear up the trouble. Immersing the parts in several boiling water rinses for fairly long periods of time may be sufficient in some cases to dissolve these trapped chemicals. Another method which is meeting with some success involves dipping the plated and rinsed parts into a water displacing solvent, followed by a drying operation. These water displacing solvents are volatile compounds, capable of displacing water solutions from a metal surface, and will evaporate during the drying operation, or can be removed in a vapor degreasing unit.

Heavily buffing the casting surfaces to flow or smear metal over any surface holes or other defects is helpful in that it closes up the surface. The same result may be accomplished by heavily buffing the preliminary copper plate if it is used. In the latter case it sometimes helps to bake the castings to completely dry out the chemicals trapped in cavities or pores before the flowing (buffing) operations.

With any method used on castings it is essential that a final protective film of lacquer, preferably in the form of several thin coats, be used to prevent atmospheric moisture from reacting with any materials possibly left behind in the cavities of the castings.

Ormolu Gold Finish

Question: Can you send us information on the production of a finish known as ormolu gold?

B. S. A.

Answer: Ormolu gold finish was one which was used years ago but which is little used today. The following details for producing ormolu gold were taken from the book, "Metal Coloring and Bronzing" by Arthur H. Hiorns. This book is now out of print.

"Ormolu Colour—To obtain this fine colour on gilt work it is first lightly scratch-brushed, strongly heated, and then allowed to cool a little. The ormolu colouring matter is a mixture of haematite, alum, and seasalt made into a thin paste with vinegar, and applied with a brush until the surface of the article is covered, except such parts as are required to be burnished. The article is heated until it begins to blacken, then removed from the fire, plunged in cold water, washed, and rubbed with a brush which has been dipped in vinegar or dilute nitric acid.

"French clocks and other ornamental work are coloured in this way. The gilt articles are lightly scratch-brushed, then coated with a paste of potassium nitrate, alum, and red iron ovide reduced to a fine powder, and worked into a paste with a solution of saffron, annatto, or other colouring matter, according to the tint required. When the gilding is strong, the article is heated until the coating of the above mixture curls over by being touched with the wet finger. When the gilding is only slight, the mixture is only allowed to remain upon the article for a few minutes. The article is then well washed with water to remove the paste. Such parts as have acquired too deep a colour are afterwards struck with a brush made with long bristles. By a series of vertical strokes with the brush the uniformity of surface is produced. If the first operation has not been successful the colouring is removed by dipping in dilute sulphuric acid, and after well rinsing the operation is repeated.

"Red Ormolu is produced by means of a mixture of—

Alum	30 parts
Potassium nitrate	30 "
Zinc sulphate	8 "
Common salt	3 "
Red ochre	28 "
Iron sulfate	1 "

"To these may be added annatto or madder ground in water.

"Yellow Ormolu is produced by the following:

Potash alum	50 parts
Red ochre	17 "
Zinc sulphate	10 "
Common salt	3 "
Potassium nitrate	20 "

"Dead Ormolu, for clocks, is composed of—

Potassium nitrate	37 parts
Alum	42 "
Common salt	12 "
Powdered glass and calcium sulphate	4 "
Water	5 "

"The whole of these substances are well ground and mixed with water."

Hard Silver Plating

Question: We would like to find a method to deposit a hard silver coating on copper for electrical contacts, and

would appreciate any information on the subject.

R. H. D.

Answer: Unfortunately, in silver plating we do not have a comparable situation to that of chromium plating, as it is not possible to increase the hardness of silver deposits appreciably by any variations in plating technique. While it may be true that a bright silver deposit may be slightly harder than a matte white silver deposit, the difference in hardness is minor and would probably not increase the life of the electrical contacts to any appreciable extent.

Plating With X-Rays

Question: Will the treatment of electrolytic solutions with electro-magnetic (X-Ray) radiation increase the rate of metal deposition? If such treatment is a theoretical possibility, the practical use of X-Rays on radioactive isotopes assumes practical importance. Can you supply any information or references on this subject?

J. G. C.

Answer: Increasing the amount of ionization of an electrolyte such as copper sulfate does not increase the rate of deposition per se. It lowers the electrical resistance and thus permits passage of higher currents at a given fixed potential; if more current can be passed through, more metal will be deposited, according to Faraday's Law. Increased ionization can be obtained by raising the temperature of the electrolyte but the nature of the deposits obtained under such "high speed" conditions may be considered inferior to those obtained under normal ionization conditions. On the other hand an actual change in valence, if brought about by electromagnetic radiations, will give an increase in the amount of metal deposited, above what is normally expected by Faraday's Law. Thus with cupric sulfate converted by radiations to cuprous sulfate, 100% prior to deposition, an apparent cathode efficiency of 200% would result. While reductions in valence do occur in metallic compounds under action of radiations, notably in the case of silver bromide, I seriously doubt the commercial or even laboratory application of such a process in the case of copper sulfate, since the process if at all feasible would be highly transient and the equilibrium value would not be very far to the right in the direction of valence reduction.

(Answer by Mr. Joseph B. Kushner)

Excessive Pickling Causes Rough Plated Surface

Question: We are having trouble copper plating B-1112 steel parts. Our cycle is as follows:

1—Sand belt finish.
2—Vapor degrease.
3—Acid pickle ¾-1 hr.
4—Two cold rinses.
5—Copper plate 15 mins. at 10 asf.
6—Cold rinse, rinse in 50-1 acetic acid, rinse again, and dry.

Our trouble is poor adhesion and rough plating, also blisters. We have tried several cleaning procedures. and would appreciate your help.

S. T. R.

Answer: Your problem with poor adhesion and blisters is undoubtedly due to the extreme overpickling you are doing. B-1112 is free-machining screw machine steel having a cold-rolled finish that should not require any great amount of acid pickling. The prolonged pickling cycle you are using will cause hydrogen absorption, a prime cause for blistering, and etching and pitting, which will cause rough plating. Our suggestion would be to use a simple cleaning cycle consisting of a vapor degrease, alkaline clean, either soak or electroclean, rinse, acid dip (5%) in hydrochloric acid, rinse, dip in sodium cyanide, and copper plate. Solid particles in the bath, either from the anodes or carried in from the air or parts being plated, may also cause rough plating, and can be remedied by frequent filtration or by using diaphragms between the anodes and cathodes.

PATENTS

Marine Electrocleaning and Electropickling Apparatus

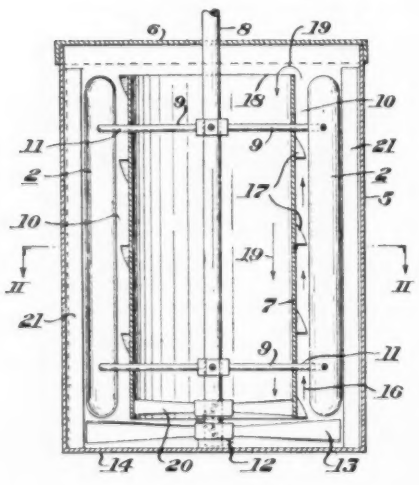
U. S. Patent 2,476,286. *G. C. Cox.*

Apparatus for electrolytically cleaning the surface of metal parts which are submerged in an electrolyte, comprising a frame, a plurality of elongated electrodes mounted in said frame, a plurality of elongated highly conductive elements mounted in said frame between said electrodes and the surface to be cleaned and electrically insulated from and spaced from said electrodes, said highly conductive elements being in a plane parallel to said electrodes, electric current shields partially surrounding said electrodes and highly conductive members, said shields being situated to collect material removed from the surface being cleaned to direct such material away from the electrodes and highly conductive elements, and means to cause an electric current to flow between said electrodes and the surface to be cleaned.

Polishing Apparatus

U. S. Patent 2,480,238. *M. B. Hammond & R. S. Komarnitsky, assignors to Standard Steel Spring Co.*

Apparatus for polishing articles, comprising a container adapted to hold abrasive suspended in a liquid, a rotatable drum arranged vertically within and spaced from the wall of the container, said drum being open at its top and bottom, means for rotating the drum, means for supporting and moving the article through the space between the container and drum, and means for forcing the abrasive upwardly in the space containing the article and then downwardly in the space within the drum.



Inhibited Phosphoric Acid Solution

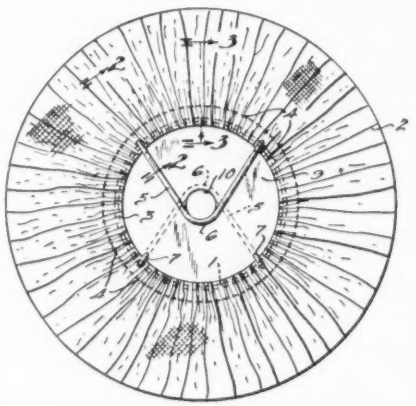
U. S. Patent 2,482, 104. *F. E. Dolian.*

A composition inhibited against corrosion of ferrous metals by phosphoric acid and consisting of a 25% aqueous H_3PO_4 solution containing .1% as As_2O_5 and .1% of 4-methyl-2-hydroxy quinoline.

Buffing Wheel Section

U. S. Patent 2,480,409. *A. R. Glaney, assignor to Georgia Buff Co.*

A buffing wheel section comprising an annular buffing section of fabric, an annular metal ring, said buffing section being mounted on said ring, and V-



shaped wire members having their outer ends secured to said ring at annularly spaced points and having their inner ends over-lapped to provide a shaft-receiving hub.

Electrolytic Removal of Resin from Metal

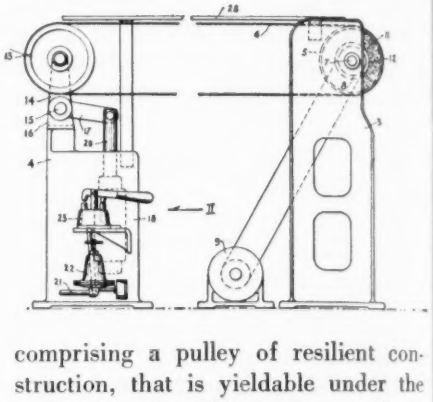
U. S. Patent 2,480,845. *M. Frager & H. Iserson*

A method for removing from a metal surface cured thermosetting synthetic plastics in a substantially pure form consisting of unmodified heat reactive resins, which method consists of immersing the workpiece in an electrolytic bath consisting of 15 parts by weight of an alkaline metal hydroxide from the group consisting of sodium and potassium hydroxide and 85 parts by weight of water, and passing a direct current of from 13 to 27 amperes per square foot through said bath and through said workpiece at a temperature of from 200 to 220 degrees Fahrenheit.

Grinding Apparatus of the Abrasive Belt Type

U. S. Patent 2,479,536. *J. A. Elmes, assignor to Ryman Enginering Co.*

A grinding and polishing machine



comprising a pulley of resilient construction, that is yieldable under the application of working pressures thereto, a second pulley, an abrasive belt extending around the pulleys, and a pneumatic pressure device for urging one of the pulleys in a direction to maintain the abrasive belt under tension.

Electrodeposition of Iron

U. S. Patent 2,480,156. *A. E. Matson & H. V. Trask, assignors to Buel Metals Co.*

The method of making electrodeposited iron of pure, brittle character by two stages of electrodeposition which comprises subjecting an electrolyte consisting essentially of ferrous chloride and containing from 150 to 250 grams of iron per liter of solution to electrolysis in a cell having cathodes and insoluble anodes and wherein from 2% to 10% of the iron is oxidized to ferric iron, withdrawing the electrolyte from said cell, cooling at least a portion of it, adding free acid thereto and introducing the electrolyte so conditioned into a second cell containing cathodes and soluble iron anodes produced by electrolysis in the first mentioned cell, subjecting said solution to electrolysis in the second cell to produce a brittle deposit on the cathodes therein by maintaining in the second cell an aqueous solution consisting essentially of ferric and ferrous chloride at a total concentration of 150 to 250 grams of iron per liter of solution of which from 1 to 5 grams is ferric iron, maintaining the temperature of the

solution below 50 degeres C.. the pH from 1 to 1.2 and the current density of deposition not less than 25 amperes per square foot, withdrawing the electrolyte from the second cell and reintroducing it into the first mentioned cell for further electrolysis therein.

Process for Plating Metal on Iron or Steel by Application of a Cold Solution of a Salt of the Metal

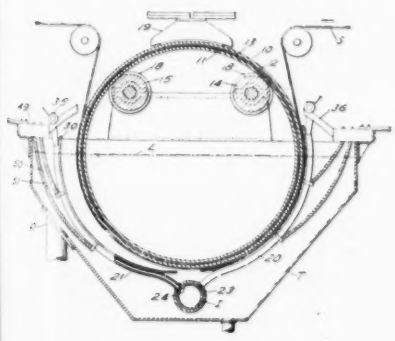
U. S. Patent 2,477,851. *A. Arent, assignor to Arthur Arent Laboratories, Inc.*

The process for treating ferrous metal surfaces which includes the steps of wetting the surface with muriatic acid, washing the surface with water to remove the acid, subjecting the washed surface to the action of an aqueous solution of citric acid having a concentration of not less than twenty-five per cent, and subsequently subjecting the surface to the action of an aqueous solution consisting substantially of citric acid having a concentration of not less than twenty-five per cent and a dissolved lead salt.

Electrolytic Apparatus for Treatment of Moving Strip

U. S. Patent 2,477,808. *C. G. Jones.*

In apparatus for progressively subjecting a strip of electrolytic action, a vessel for electrolyte solution, means for passing the strip therethrough along an arcuate path including a substantially cylindrical contact element supported for rotation about its axis adapted to engage the radial inner face of the strip while traversing said path, a plurality of curved electrodes spaced radially outward from said path conforming substantially thereto and movable independently toward and away from the element about a common axis parallel to the axis of but outwardly spaced from said path adjacent the element, each electrode having a passage extending arcuately therein and apertures directed radially inward



therefrom toward the axis of said path, a collar surrounding said common axis supporting each electrode from one end thereof and providing a port communicating with said passage, a pipe extending through all the collars about which said collars are respectively rotatable, the pipe having ports respectively communicating with the collar ports when the corresponding collars are in positions to align their ports therewith, and means for supplying electrolyte under pressure of said pipe whereby said electrolyte is ejected from the apertures selectivly in accordance with the positioning of the several curved electrodes and their supporting collars relatively to said pipe.

Contact Roll for Abrasive Belts

U. S. Patent 2,477,602. *H. R. Herchenrider, assignor to Minnesota Mining & Mfg. Co.*

An abrading device comprising an abrasive sleeve superimposed around the peripheral surface of a pressure roll and frictionally held thereon during use, said roll comprising a plurality of substantially radial segments disposed peripherally thereof, each of said segments comprising material, a portion of which, along a substantial length of the segment at its outer end, has been constructed to render it relatively dense and hard, while the remaining portion is readily yieldable.

Buffing Compositions

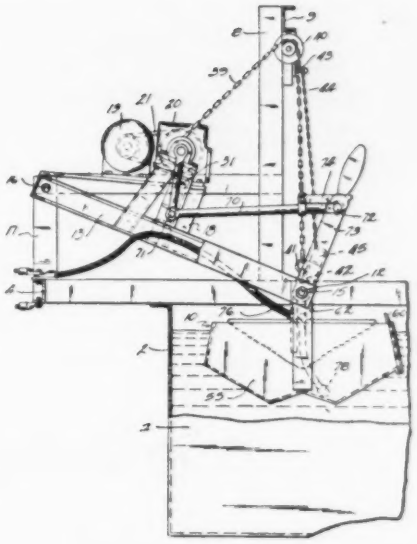
U. S. Patent 2,482,667. *D. Gray, assignor to Oneida Ltd.*

A stable, substantially non-separating liquid buffing composition consisting of a free-flowing water solution of an amine salt of a higher fatty acid, said salt being substantially non-volatile under buffing conditions, the ratio of water to said salt being not more than about 10:1, and an abrasive present in an amount of 5-10 times the weight of said salt, said abrasive being permanently suspended in said solution.

Plating Machine

U. S. Patent 2,479,323. *J. V. Davis, assignor to The Udylite Corp.*

In an electrolytic plating apparatus, a tank adapted to contain the electrolyte, a shaft supported horizontally across said tank, a work container mounted for swinging movement on said shaft and in said tank and having



side, end and bottom walls, said bottom wall being W-shaped in cross section and comprised of four plane surfaces forming three vertices parallel to said shaft, the angle between an inner and an outer surface of said W-shaped bottom inside said work container being about 125 degrees, and the angle connecting said inner surfaces inside said work container being about 215 degrees, an insoluble container for soluble anode material in the form of a perforate basket positioned within said work container and swingably mounted on said shaft, and a cathode contact extending into said work container.

Method of and Materials for Treating Surfaces of Iron, Zinc, and Alloys of Each

U. S. Patent 2,479,423. *E. Snyder, assignor to American Chemical Paint Co.*

The method of simultaneously cleaning metal surfaces from the class of iron, zinc and alloys of each and providing them with a corrosion-resistant and paint bonding film comprising treating the surface with an aqueous preparation containing as its essential active ingredients both primary and secondary phosphates from the class which consists of alkali and ammonium phosphates, a water-soluble, surface-active emulsifying agent and added solid, undissolved, normal phosphate from the class consisting of ferric and aluminum phosphates, the pH of the preparation being between 5.0 and 6.0 and being greater than that corresponding to the monobasic phosphate present alone and lower than that corresponding to the di-basic phosphate present alone.

Engineering Data Sheet

Engineering Information Useful In Designating Metallic Surface Treatments

Plated Coatings for Special Non-Decorative Applications

In the following table will be found a list of suggested thicknesses of plated deposits for miscellaneous applications where corrosion resistance or decorative effect of the deposit is of minor importance. The figures given were taken from a number of sources and are not to be considered as standards, but they will serve as a useful guide when such applications require consideration.

METAL DEPOSITED	THICKNESS	APPLICATION	REFERENCE
COPPER	.00005″-.0001″	Dip soldering.	*Chrysler Corp.*
	.00005″	Lubricant in wire drawing.	
	.0001″-.00025″	Prevention of scuffing of steel gears.	
	.0003″	Prevention of decarburization of steel during heat treatment.	*Beatson—Metal Finishing* 6/94/49
	.001″	Stop-off to prevent carburizing of steel.	*Chrysler Corp.*
CHROMIUM	.00001″	Matching color of stainless steel parts with chrome plated hardware, etc.	*Packard Motor Car Co.*
SILVER	.00005″-.0001″	Aid to soft soldering of steel parts.	*Chrysler Corp.*
	.00015″	Conductivity of electrical connectors (copper).	
	.001″	Electrical Contacts.	*Chrysler Corp.*
	.002″ (over nickel)	Sliding electrical contacts.	
NICKEL	.001″	Lessening friction in sliding contact with steel.	
TIN	.0001″	Aid to soldering steel.	*SAE & Ford.*
	.0002″	Aid to soldering brass.	*Beatson—Metal Finishing* 6/94/49
	.0002″-.0004″	Prevention of wear of steel parts in contact.	*SAE*
	.0002″-.0006″	Stop-off to prevent nitriding of steel.	
LEAD-TIN ALLOY	.0002″ .0005″-.001″	Aid to soldering with rosin flux. Corrosion prevention after torch soldering.	*Wallace—Mat. & Meth.*, 5/49 *Chrysler Corp.*

Let's Get Technical.....

This month we are not going to take up any space for photographs, artwork, or snappy headlines. These are two pages of technical facts, printed on both sides so you can remove the sheet neatly and put in your file on "Rectifiers". Good thing to have around to check against various makes of rectifiers when you are in the market for D. C. power.

We're having reprints made – available on request in case you want to send a copy to the Purchasing Department.

NEW FEATURES....

The following features, which have all been thoroughly tested, and have been used on special jobs, are standard on all Selectro-Platers.

Current Overload Relay. A factory adjusted relay is connected across the ammeter shunt and associated with the main contactor so that the Selectro-Plater automatically shuts down if the load current exceeds the nameplate rating by about 5%. This is in line with recently adopted NEMA (National Electrical Manufacturers Association) standards on electroplating rectifier ratings. The relatively small quantity of metal required for rectifier elements, and consequently the low thermal capacity, makes intermittent "overload" ratings impractical if not downright dangerous. The cost of rectifiers is such that, if more capacity is needed, it is good sense and good economics to specify a larger unit in the first place – or add a second unit in parallel.

The current overload relay provides reliable protection against current overload.

"Single-Phase Protection". Sometimes one of the three phases supplying a rectifier will disappear, due perhaps to a blown fuse in the local cutout box or back on your main switchboard. When this happens the rectifier may stop or it may not, depending upon which particular phase is out. If it does not shut down, but continues to operate, it does so on only some of the transformer windings and some of the rectifier stacks. This is known as "single-phasing" and is analogous to a six cylinder motor firing on only four cylinders. If the operator does not realize what has happened, and tries to squeeze out the full rated capacity, he may cause permanent and expensive damage.

With the new "anti-single-phase" circuit, your Selectro-Plater will shut down automatically if *any* one of the three phases disappears, and cannot be restarted until the trouble has been corrected. It may never happen in your plant, but it's nice to know you have positive protection.

Dual Input. The standard input arrangement on all Selectro-Platers will allow you to connect up for 230 or 460 cycle three phase supply without elaborate rewiring. Special input terminal board, clearly marked, shows how to connect for either type of input. The 230 volt connection has sufficient margin for operation from 208. If you have an unusual A.C. supply – for instance 180, 260, 550 or some other odd voltage – you can specify that your Selectro-Plater be built for this *single* voltage at no additional cost. Also, 50 cycles instead of 60, at no extra cost.

Continuous Fan Operation. Generally, when a rectifier is shut off, while the tank is being loaded or unloaded, the fan also stops. In the Selectro-Plater the fan keeps running, (drawing negligible current) rapidly cooling off the rectifier stacks, bringing them down to room temperature ready for a fresh start. During those extra-hot days when you want to operate at full capacity, continuous fan operation is desirable. Note: the fan stops when the fuse box switch is pulled at the end of the shift.

Fan Fuses. In all Selectro-Platers of the fan-cooled type we incorporate a separate fuse block protecting the fan motor and pushbutton control circuit—an arrangement preferred by inspectors in some localities. Incidentally, the fan motor circuit is so arranged that the Selectro-Plater cannot be turned on unless voltage is present across the fan motor.

Improved Switches. During the war there were occasional reports of voltage control switches damaged by extra powerful operators. Some of the torque-transmitting parts were made of ceramic, a good insulator but not very high in tensile strength. These parts are now made of tough laminated plastic and field observations show that switch breakages from this cause have been eliminated.

CLIP FOR YOUR FILE

Let's Get Technical... (cont'd)

PLUS — ORIGINAL FEATURES

Following is a brief recap of standard features with which you may already be familiar. Like to remind you that most of these were originally developed by Green Electric and have been standard in Selectro-Platers for nearly ten years.

Multiple Coat Finish. Our selenium stacks have a multiple-coat baked finish, corrosion and moisture resistant, identical with that specified for Navy rectifiers.

Downdraft Cooling. Air intake enters top of cabinet — simplifies attachment of air intake duct required for some locations.

Skyscraper Construction. Space-saving cabinet, tall and narrow, mounted on caster wheels for easy installation.

49 Step Voltage Control. 49 steps, zero to maximum, provide fine control for nearly any metal finishing process. Optional, at no additional cost, 49 steps over narrower range. For example, "4 to 8 volts" instead of "zero to 8 volts", gives still finer control over the narrower range.

Large Meters. Output voltmeter and matching ammeter, 4½" rectangular type for good visibility. Factory checked for accuracy during final full-load test.

Full-Load Test. Every Selectro-Plater is individually tested at full load rating for efficiency, temperature rise, power consumption and is completely checked before shipment.

Monitor System. Red lamp and buzzer warning to operator if rectifier stacks become too warm for any reason.

Fan Thermostat. Thermostat mounted between rectifier stacks and downdraft fan automatically shuts off Selectro-Plater if air flow is blocked for any reason.

Twin Output Terminals. DC output terminals on both sides of cabinet so tank busbars may be connected to either side. Useful also for parallel or series connections of Selectro-Platers.

Indicator Lamps. Green pilot lamp, visible across shop shows when Selectro-Plater is operating. Red lamp (see "Monitor") warns of abnormal conditions.

Instruction Book. Detailed, individually compiled book, covers installation, operation, circuit schematic, and simple maintenance routines.

WANT MORE FACTS?

Ask us, or any of our representatives, to send you reprints of series "Rectifiers for Electroplating", also "Rectifier Installations", and "Rectifier Circuits and Power Costs". Representatives: Corl Chemical Co., Seattle • Crown Rheostat & Supply Co., Chicago • Industrial Chemical & Equipment Co., Minneapolis • A. J. Lynch & Co., Los Angeles • Munning & Munning, Inc., Newark • Frederic B. Stevens, Inc., Detroit • Allen I. Williams Co., Denver

CLIP FOR YOUR FILE

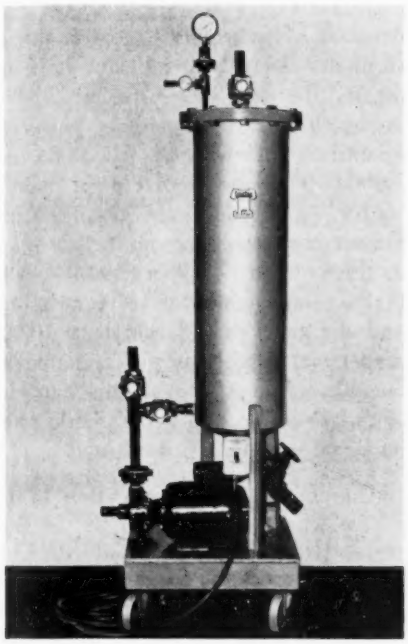
New Methods, Materials and Equipment for the Metal Finishing Industries

Recent Developments

Low Cost Filter Units

Titeflex, Inc., Dept MF, 500 Frelinghuysen Avenue, Newark 5, N. J.

Production of a series of new, low-cost filter units, especially adapted to the filtering of light solutions has just



been announced by this firm. Designated as the SEN series, the new units contain all of the features of regular Titeflex filters, but are produced at minimum cost. They require no replacement parts such as bags, pads, etc. Filtering is accomplished by filter-aid supported by rigid membranes of wire-mesh or porous stone. A few cents worth of filter-aid handles each batch filtered, it is claimed. In addition, the new units are cleaned by a backwash system, without taking the machine apart and without handling the sludge in any way. Available in plain steel, rubber-lined steel and Type 316 stainless, these filters operate efficiently with both cyanide and acid solutions. Chamber capacities are: One sq. ft. (delivers 400 g.p.h. open pumping); three sq. ft. (delivers 560 g.p.h.); 4½ sq. ft. (delivers 1,020 g.p.h.); and nine sq. ft. (delivers 2,280 g.p.h.). Standard equipment includes filter chamber, pump, motor, motor starter and all valves and fittings, assembled on a portable platform. Precoat tanks can also be supplied at slight extra cost. Full information and prices will be supplied by the manufacturer upon request.

Rust Preventive

International Rustproof Corp., Dept. MF, 12507 Plover Ave., Cleveland, O.

The above firm has just placed on the market a rust preventive for use on aluminum, chrome, ferrous, or non-ferrous metals. The product, known as Rustarest No. 30, provides a coating over plated parts—as well as bare metal, and although hard and tough, is pliable enough to take bending or curving, it is claimed.

The manufacturers state that it is a clear, transparent coating that dries quickly without need of baking. When Rustarest is used as a primer, it prevents paint from chipping off, but the actual Rustarest coating will not chip or crack under any normal fabricating application, according to the firm. The product expands and contracts with the metal regardless of temperature extremes, intense vibration, or abnormal flexing. They also state that its application is the prevention of corrosion and rusting actions on stored parts during long shipments or storage time.

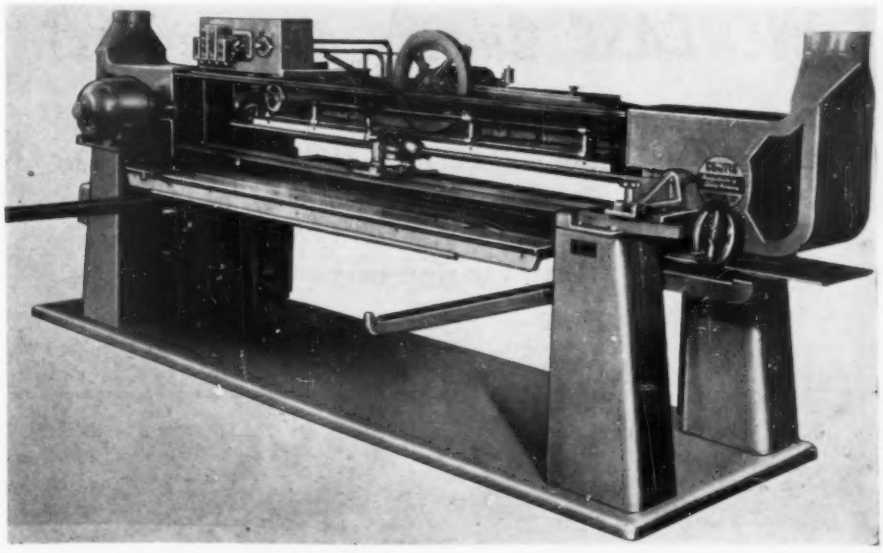
Double Belt Hydraulic Stroke Sander

Curtis Machine Div., Dept. MF, Lincoln Park Industries, Inc., Jamestown, New York.

The new Curtis 43R1-DB double reversible belt, hydraulic stroke sander—a big brother to the successful single belt Curtis 43-R1 Hydraulic—has now been perfected and introduced to the metal working industry as a heavy duty, superspeed production polishing and sanding machine. The speed of the double, hydraulic-driven head is infinitely variable up to 250 strokes per minute. A non-stop stroke adjustment feature permits automatic adjustment of the stroke lengths from 16 inches to 8 feet without stopping the machine, thus enabling the operator to accommodate the stroke to the work without interruption.

The two belts, each driven by its own motor, are independently reversible and may be used inter-changeably without stopping he machine or removing the work from the table. This permits rough and finishing operations in one set up. All operational controls are grouped on a compact panel within easy reach of the operator.

The weight, as well as the operational stress of this heavy duty 43R1-DB, is evenly distributed over the four pedestal base. Stepping up production rates 2 to 3 times, this sander is said to produce finished surfaces of exceptional smoothness at reduced costs, and practically eliminates operator fatigue, it is claimed.

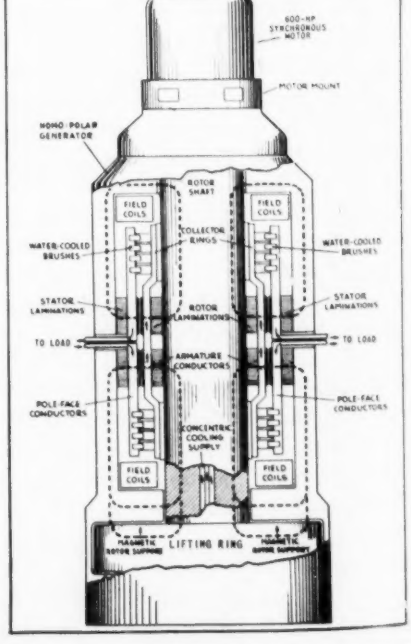


Homopolar Generators for Extremely High Amperage, Low Voltage D.C. Power

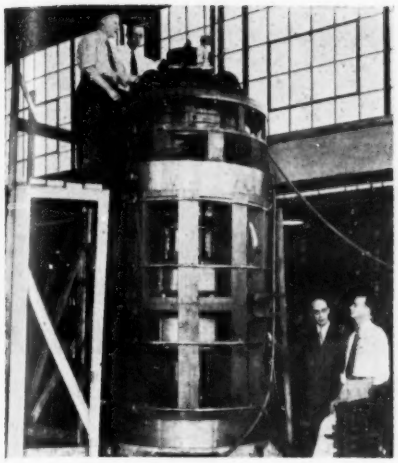
Electric Products Co., Dept. MF, 1725 Clarkstone Rd., Cleveland 12, O.

Recent developments in electrolytic processes throughout industry have created a need for tremendous quantities of low-voltage, high-current d-c power. The Homopolar Generator may offer the only practical and economical means of producing tens . . . even hundreds of thousands of amperes at a few volts. Recent inquiries from the electrolytic industry have indicated the need of equipment capable of supplying low-voltage d-c power in quantities of 50,000, 100,000 and 1,000,000 amperes from a single source. A conventional motor-generator set is not the answer to this need, as this company's experience indicates that a motor-generator set (one motor and one generator) larger than 10,000 amperes at 25 volts is not economically feasible. A machine of this capacity would be quite expensive, aside from its great physical proportions.

This firm is now presenting to industry what is claimed to be the first practical Homopolar Generator, one capable of delivering 21,000 amperes at 18.7 volts. It is claimed that very little change in the Homopolar Generator size and design would enable



Sectional view showing internal design of homopolar generator manufactured by Electric Products Co.



Homopolar Generator in final stages of mechanical tests prior to testing electrically. Brushes with accompanying water-cooling system are not yet installed. At top of machine, taking instrument readings, are (l. to r.) Walter Sanow, Engineer, and R. W. Helmig, Vice-President in Charge of Manufacturing. At side of machine, examining collector buses are (l. to r.) F. K. Rouge, Vice-President and General Manager and R. J. Berry, President.

this machine to deliver 100,000 or more amperes at low voltage, suitable for processes such as electrotinning, electroplating, electropolishing, electrogalvanizing and so on. The size of a Homopolar Generator is proportional more to the voltage developed than to its current capacity.

Although the new patented design of the Homopolar Generator is a recent development, electrical equipment manufacturers have previously built several with varying degrees of success. It is the only type of generator that produces pure continuous d-c power. However, one serious fault of earlier Homopolar designs has been poor voltage regulation. The Homopolar design, improved and patented by *J. V. Caputo* and manufactured by The Electric Products Co., incorporates features that make it commercially practical.

Although it has been a long road of engineering and development, this firm claims that the Homopolar Generator will bring to Industry another source of low-voltage, high-current power with these outstanding advantages:

1—A source of pure direct-current power.
2—More amperes per square foot of floor space.
3—Lower first cost.
4—Less operating cost.
5—Reduced maintenance.

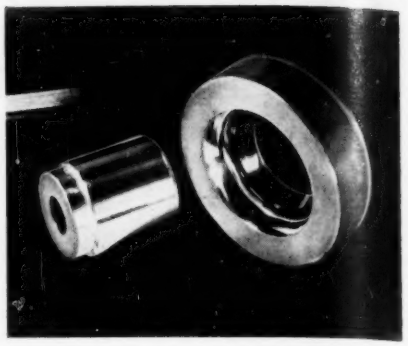
Self-Regulating High-Speed Chromium Plating Solution

United Chromium, Inc., Dept. MF, 51 E. 42nd St., New York 17, N. Y.

This firm has just released information on a new self-regulating high-speed chromium plating solution. The new Unichrome SRHS chromium plating solution is said to differ in several very important respects from the conventional solution which has been in use since 1924. It is self regulating; it has higher cathode efficiency; it has better covering power; it has a wider bright plate range; it is less sensitive to interruptions in current; when plated over nickel, it has less tendency to produce "rainbow plate" at the line where the chromium stops.

The solution is made up and maintained with but a single salt, Unichrome Compound Cr-100. The only maintenance required is the addition of Unichrome SRHS compound to adjust the concentration of the solution to the desired Baumé. The acid catalyst radical concentration is automatically self regulated, therefore the solution is always in good plating balance.

The cathode efficiencies of the SRHS chromium bath are claimed to be substantially higher than those of a conventional chromium plating solution. As a result, deposits of equal thickness can be obtained in less time than with the conventional solution. For example, when plating at 1 or 2 amperes per square inch at 110°F. in a 31° Baumé



Hard plating of dies is 30-50% faster with new chrome process.

Unichrome SRHS Bath, cathode efficiencies are 50% greater than those of the conventional solution of the same concentration operated under identical conditions. Under these conditions, plating in a SRHS Bath will require about 1/3 less time. Moreover, because the SRHS Bath permits the use of higher current densities, it is possible to shorten still further the plating time, if desired.

Because the Unichrome SRHS Bath has higher cathode efficiencies, electrical power put into the plating solution deposits more chromium than the same amount of power put into a conventional chromium solution, which can be translated into a saving in power costs of more than 1/3.

The SRHS Bath is also claimed to have better covering power than a conventional chromium solution. This feature may eliminate the necessity for expensive auxiliary anodes.

The Unichrome SRHS Bath has a considerably wider bright plate range, which allows the plater to use higher current density without the danger of chromium burning in the high current density areas. The wider bright plate range also makes it possible to obtain good coverage at low densities, a feature of particular interest in plating pieces that are irregular in shape.

In addition to these features there are others which tend to minimize rejects and make it possible to produce consistently high quality plating. A common cause of rejects is gray chromium, caused by plating over passive nickel. The SRHS Bath is claimed to have more activating action than the conventional bath on bright nickel and, as a result, this type of gray chromium will seldom be obtained from the SRHS Bath. Another common cause of rejects is caused by interruptions of cur-

rent during the plating process. As the SRHS Bath is less sensitive to these interruptions of current it is less likely to produce rejects. Rejects due to rainbowing are also said to be minimized because the new bath, unlike the conventional chromium solution, has little or no tendency to produce rainbow plate at the end of the chromium deposit when it is plated over nickel.

The physical and chemical properties of the deposit obtained with the SRHS Bath are said to be the same as those of deposits from a conventional solution. Standard chromium plating equipment is generally satisfactory for use with the Unichrome SRHS Bath. A steel tank with a suitable plastic lining is preferable, although both lead-alloy lined and ceramic-lined tanks may be used. Thorough rinsing prior to chromium plating is recommended, and facilities for this should be available. Standard lead alloy anodes are recommended.

The SRHS solution may be used for all types of chromium plating. Numerous commercial installations are already operated. Unichrome SRHS Compound is sold by United Chromium, Inc. in the United States and will shortly be sold in Canada through United Chromium, Ltd. The use of the SRHS Bath is covered by letters patent and applications for letters patent. However, it is not necessary to sign any license agreement for the use of the bath.

Plating Thickness Micrometer

Krouse Testing Machine Co., Dept. MF, 573 E. Eleventh Ave., Columbus, O.

This firm has recently announced their new magnifying micrometer for measuring the thickness of plated or painted coatings on magnetic or non-magnetic base metals. The instrument is light in weight (2 oz.) and is intended for shop use. It operates on the principle of measuring the force necessary to overcome the magnetic attraction of the base metal or plated coating with the precision permanent magnet incorporated in the instrument. Accuracy is claimed to be within 10%. Various gages are available for coating thicknesses up to .080". The instrument is said to be usable for magnetic coatings (nickel, iron) on either magnetic or non-magnetic base metals, as well as all non-magnetic coatings on magnetic base metals. No electrical power or calibration curves are required, it is claimed. Further details may be obtained by writing to the company at the above address.

All Around Burnishing Composition

Chemclean Products Corp., Dept. MF, 64 Sixth Ave., New York 13, N. Y.

This firm announces the development of a new burnishing compound called Burnish-All, which is inexpensive and efficient, it is claimed. Its outstanding advantage is that it can be used on a variety of metals; an all-around composition. It is claimed to bring up a more brilliant lustre on most metals and their alloys in less time than is usually required by materials now being used for this purpose. Burnish-All is said to be equally effective when used either with burnishing medium or in self-rolling operations. Packing is in 325 lb. barrels.

Plating Stop-Off

Michigan Chrome and Chemical Co., Dept. MF, Detroit 7, Mich.

Recently the above firm announced Miccrowax, a new, single-material wax for selective plating stop-off. It is claimed to be especially suited for masking on complicated parts and sharp edges. Miccrowax is an odorless wax that will not crack and has a remarkable degree of adhesion, even when used on flat surfaces, it is claimed. Miccrowax requires no prime coat on material before its application. This means only one dip tank is necessary for the complete operation. Miccrowax hardens immediately after the part is dipped, thereby minimizing preparation time and speeding up production on parts before plating, according to the firm.

Business Items

Daniels to Distribute LaSalco Supplies and Equipment

LaSalco, Inc., 2818-38 *LaSalle St., St. Louis 4, Mo.*, manufacturers of electroplating and polishing equipment and supplies, take pleasure in announcing the appointment of *Daniels Plating Barrel & Supply Co.*, 129 *Oliver St., Newark 5, N. J.*, as their distributor for their products in the northern part of New Jersey. Complete information on all LaSalco equipment and products may be obtained through this local office.

Platecoil Extends Coverage

The *Platecoil Div.* of the *Kold-Hold Mfg. Co., Lansing, Mich.*, has appointed four new eastern representatives. They are all highly-trained technicians offering manufacturers special help with their industrial heating problems. They will provide engineering assistance in connection with the new platecoil method of tank heating.

The new representatives are as follows: The *Paul B. Huyette Company, Inc.*, Philadelphia; *H. R. Houghton Co.*, Baltimore; *W. B. Parsons Co.*, Boston; *Gerald B. Duff Co.*, Newark, N. J.

Lundberg Heads Osborn's Advertising and Sales Promotion

The appointment of *George R. Lundberg* as Director of Advertising and Sales Promotion has been announced by *The Osborn Manufacturing Co.*

Mr. Lundberg has been associated with Osborn in various capacities for the past 17 years. For the last two years he was Chief Accountant. Before that he was Personnel Manager, Sales Service Manager of the Moulding Machine Division, and Brush Sales Representative in Midwestern Michigan.

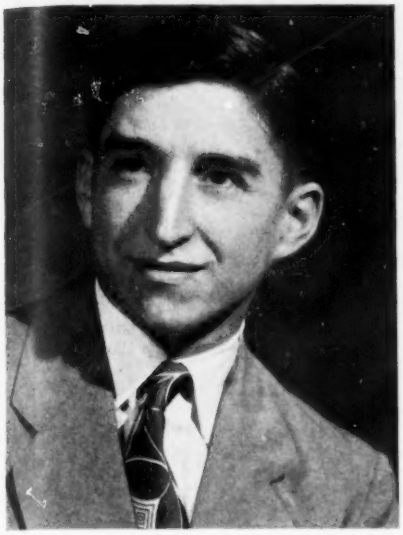
Mr. Lundberg has been a resident

George R. Lundberg

in Cleveland for over 23 years. He is a member of the University Circle Kiwanis Club, the Industrial Marketers of Cleveland and the Cleveland Advertising Club.

Stabile New Secretary of Sulphur Products Co.

Wilfred S. McKeon, president of



Samuel J. Stabile

Sulphur Products Company, announced recently the appointment of *Samuel J. Stabile* as Secretary-Treasurer of that corporation.

Mr. Stabile is an honor graduate of St. Vincent College. He received the degree of bachelor of science in business administration with the Class of '48. He was until recently connected with the Pittsburgh Paint Supply Company of Pittsburgh.

Mr. Stabile will have immediate personal charge of the affairs of this company at their office in Greensburg.

Crutcher Appointed Credit Manager of Nichols Wire and Aluminum

The Nichols Wire & Aluminum Co. is pleased to announce the appointment of *Ross Crutcher* as Credit Manager.

Mr. Crutcher worked for the Nichols Company for eighteen years, from 1922 to 1940 as Credit Manager. After his resignation in 1940, he was Credit Manager for the Paraffine Companies, Inc., Eastern Division, at Somerville, N. J., serving in that capacity until July of this year.

Apothecaries Hall Celebrates Its 100th Anniversary

Apothecaries Hall Co., Waterbury, Conn., a unique mercantile and manufacturing concern, celebrated its hundredth anniversary Saturday, October 29, at a banquet at the Hotel Elton, Waterbury.

Founded in 1849 by a group of physicians and businessmen as a drug store, it was very soon selling glass, white lead, industrial chemicals, and fertilizers. The company at present has several major divisions, including wholesale and retail drugs and paints, a foundry, a heavy chemicals division, a well-staffed research laboratory, and a large plant engaged in the manufacture and distribution of fertilizers and insecticides. Products of the company's own manufacture also include industrial metal cleaners; institutional and dairy detergents; nickel, copper, brass, cadmium and zinc anodes; buffing compositions; and numerous agricultural sundries. The company's Liberty Brand fertilizers, insecticides and fungicides are familiar to farmers from Maine to Long Island.

The company has always maintained an enviable record of service in the community, in the state, and beyond. Two of the early officials of the company were mayors of the city of Waterbury, one a town clerk, and one comptroller of the State of Connecticut. The two buildings which have been occupied by the company's retail outlet on the triangular piece of land facing Exchange Place in Waterbury have long been landmarks of the city. The original building was a colonnaded structure built in 1829. The seven-story "flat-iron" building, constructed in 1893, now occupying the site, is still owned by the company. Warehouses and general offices are located on Bene-

dict Street in Waterbury, and a non-ferrous anode foundry, on Manhan Street. The company's largest plant, the fertilizer factory, is located in the town of East Windsor, some forty-five miles from Waterbury, in the heart of the tobacco-growing section in the Connecticut River Valley.

Noteworthy in the company's history is its relationship with the employees and the extraordinary length of service of many key people. The three senior officers, *Mr. Isaac P. Kellogg*, Chairman of the Board, *Mr. Evan H. Jones*, President, and *Mr. Levi Wilcox*, Secretary, have a total of 151 years of service with the company. Twenty-three employees received service emblems at a recent banquet, indicating individual length of service of over twenty-five years. The company instituted one of the first non-contributory group insurance policies over a generation ago. A liberal pension plan went into effect October 1, 1947, which recognizes the years of past service of the employees.

In keeping with the company's traditions, the celebration was a quiet family affair, with only the mayor, two clergymen, and some two hundred-fifty employees and spouses in attendance. As it begins its second century, despite its years and the length of service of its employees, the company still displays the same vigor, aggressiveness and enthusiasm that marked the infant enterprise in 1849.

Watkins Joins Almco as Chief Development Engineer

The appointment of *N. L. Watkins* as Chief Development Engineer of the *Almco Division of Queen Stove Works, Inc., Albert Lea, Minn.*, has been an-

N. L. Watkins

nounced by *Mr. R. C. Trow*, Manager of the Division.

Prior to Mr. Watkins' association with the Almco Division, he was with Westinghouse Electric Corporation for five years as Manufacturing Engineer at Pittsburgh, Pa. Before joining Westinghouse, Mr. Watkins had been associated with Remington Rand Corp., Elmira, N. Y. for six years and with Carl L. Norden, Inc. of Elmira, N. Y. for two years. He has had intensive metal finishing experience with special emphasis on barrel finishing.

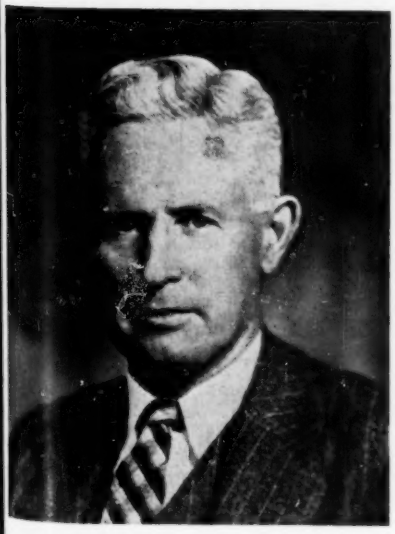
In addition to his duties at the home office, he will provide technical field service to users of Almco Supersheen Deburring and Finishing Equipment.

Mr. Trow, in making the above announcement, stated that there would be an expansion of the Free Engineering Service now offered to clients and prospective users of the Almco Supersheen equipment and materials.

Detrex Elects R. L. Murray As a Director

Stockholders of *Detrex Corp., Detroit 32, Mich.*, have just elected *Robert Lindley Murray* as a Director of the corporation. Mr. Murray is also executive vice-president and a director of *Hooker-Electrochemical Co., Niagara Falls, N. Y.*, vice-president and director of *Hooker-Detrex Inc.*, a jointly owned subsidiary of the Hooker and Detrex companies.

He is a chemical engineer with degrees from Stanford University, and is recognized as an authority in the chlorine and alkali industry. He is the author of many technical papers, and has received medals for his work in the chemical and engineering fields. During World War I he operated an explosive plant for the U. S. Government. He later became director of development, and then vice-president in charge of development and research of Hooker-Electrochemical Co. He served as a special investigator for the Chemical Warfare Service in surveying German plants manufacturing military chemicals before the end of World War II.



Robert L. Murray

Mr. Murray is very active in many community welfare projects and clubs. He was National Tennis champion in 1917 and 1918, and now has a keen interest in golf.

Plant Maintenance Show

Many subjects of vital interest to the machinery and metal trades will be on the program for discussion at the first Plant Maintenance Show, which will be held in the Auditorium, Cleveland, O., Jan. 16-19.

The four-day exposition, which will be held concurrently with a four-day conference, is the first ever devoted exclusively to maintenance. The program will be sponsored jointly by the *American Society of Mechanical Engineers* and the *Society for the Advancement of Management*. The Cleveland Engineering Society will be hosts at a dinner for visitors. *L. C. Morrow*, editor, Factory Management and Maintenance, will be general chairman of the conference.

Topics scheduled for discussion include: "Maintenance Organization

and Management"; "Budgeting the Maintenance Operation"; "Selection and Upkeep of Lighting Equipment"; "Upkeep of Motors, Controls and Distribution Equipment"; "Using Electrical Instruments in Maintenance"; "Upkeep of Floors, Walls and Roofs"; "Protecting the Plant," and "Protecting the Worker."

More than 100 exhibitors will give demonstrations of machinery, materials and methods for reduction of costs in plant maintenance.

Porter-Cable Buys Sterling Manufacturing Facilities

The Porter-Cable Machine Co., Syracuse, N. Y., manufacturers of Speedmatic and Guild portable electric tools, purchased the manufacturing rights and facilities of the Sterling Electric Tool Products Company, Chicago, Ill., for the production of the Sterling portable electric and pneumatic sanders, *DeAlton J. Ridings*, president of the Porter-Cable Company announced.

The inventory tools and production facilities which have been purchased will be moved to Syracuse, and Porter-Cable will resume manufacture of the Sterling Sanders there.

Allied Research Buys Plant

Allied Research Products, Inc., Baltimore, has purchased the building at 4004 E. Monument Street, which has housed the company for the past three years.

Plans are being drawn up for extensive renovations to the interior. These will include larger research laboratory facilities, expanded manufacturing facilities for new Iridite products soon to be announced, and more space for the company's metal finishing operations. New offices for the Administrative and Sales staffs will also be erected.

Allied is the manufacturer of the nationally known series of Iridite finishes and also operates a metal finishing job shop for manufacturers in the Middle Atlantic area.

M. J. Alef New V.-P. of Saginaw Industries

Mr. E. C. Swift, President of Saginaw Industries Co., Saginaw, Mich., announces the appointment of *Mr. Marvin J. Alef*, prominent Detroit industrial and merchandising executive, as Executive Vice-President.

Mr. Alef for many years was associated with *Mr. Joseph W. Fraser*, Vice-Chairman of the board of Kaiser Fraser Corporation, as assistant to the President and General Manager of the Army Ordinance Division at Willys-

Marvin J. Alef

Overland and later as Vice-Pres. of Warren City Manufacturing Company. Prior to this he was Vice-President and a member of the board of the Lee-Anderson Advertising Co. placing the Chrysler business. Well known in banking circles, Mr. Alef also served as Executive Vice-Pres. of the Detrola Radio Corp. and later President of the Aviola Radio Corp. at Phoenix, Ariz.

In assuming his new responsibilities, Mr. Alef disclosed that the Saginaw

Industries Co., one of the oldest stamping and plating concerns in the country, will augment its production with new products along with the expanded grille line.

Walter Binai to Engage in Consulting and Representative Work

Mr. Walter R. Binai, prominent electroplating engineer, has announced the opening of his own business as a plating consultant and manufacturers' representative at 3916 *North Parker Ave., Indianapolis, Ind.* Mr. Binai is a graduate of Lehigh Univ., and served as plating engineer for the R.C.A. Victor Corp. from 1930-1936. At that time he became associated with the P. R. Mallory Co., where he became director of engineering research and development, and was instrumental in developing a high speed silver plating process that was used extensively during the late war for plating high speed aircraft bearings. He left the Mallory Co. in 1945.

Mr. Binai was the organizer of the Indianapolis Branch of the AES, and served as its first Branch President. He has been a frequent contributor to technical journals on various plating subjects. Besides his private consulting

Walter R. Binai

practice, he will serve as a representative of the following plating equipment and supply firms:

Crown Rheostat & Supply Co.
Formax Mfg. Co.
Harshaw Chemical Co.
Industrial Filter & Pump Co.
Fulton Sylphon Co.
Division Lead Co.
Kocour Co.
Miracle Mfg. Co.

Kemen to Represent Klem Chemicals in Milwaukee

Mr. Charles Kemen has been appointed sales and service engineer representing *Klem Chemicals, Inc., Dearborn, Mich.*, in the Milwaukee area. A graduate chemical engineer of the University of Detroit with experience in metal cleaning and processing, Mr. Kemen will devote his entire time to chemical processing problems and servicing of Klem products. The appointment is part of a general expansion program undertaken by Klem Chemicals, Inc., in industrial metal cleaning and in other industries not previously serviced. Address of the Milwaukee office is 312 Wisconsin Avenue, Suite 207, Milwaukee, Wisc.

Victor Equipment Co. Purchases Mills Alloys, Inc.

Victor Equipment Co. announces the purchase of the business and assets of the Los Angeles manufacturing firm of Mills Alloys, Inc., 11320 S. Alameda St., Los Angeles, California. The purchase includes the purchase of the physical assets of Mills Alloys such as inventory, machines and equipment, the company's trade name, all patents, trademarks and formulas. The manufacturing facilities purchased by Victor will continue to be located at the leased site now occupied by Mills Alloys, and will be designated as the Alloy Rod and Metal Division of Victor Equipment Company.

Mills Alloys has been in business for

more than 25 years and is a well-known manufacturer of all types of blasting nozzles and all types of tungsten carbide hard-surfacing rod.

Wilfred McKeon Convalescing

Mr. Wilfred McKeon, President of the Sulphur Products Co., Inc. of Greensburg, Pa. was released recently from the Westmoreland Hospital where he was confined for a period of three weeks due to illness. His many friends will be glad to know that he is now recuperating at home.

Federated Expands Anode Interests

The Federated Metals Division of the *American Smelting and Refining Co.* has expanded its business in electroplaters' anodes through the acquisition of the production facilities of the Metallurgical Products Co., Philadelphia, Pa.

The additional facilities will broaden Federated's ability to serve the electroplating industry. Anodes of all types will be merchandised through 24 sales offices across the country, according to *Mr. E. L. Newhouse, Jr.*, Smelting Company Vice President in charge of the Federated Metals Division.

Production will be concentrated at the Division's Perth Amboy, New Jersey, plant under the management of *Mr. R. D. Taylor*. There, specialized equipment provides for the efficient manufacture of various types of anodes. The technical staff of Federated will be assisted by *Mr. I. W. Wilenchik*, of the Metallurgical Products Company, who will devote a portion of his time to this work.

The alloy and specialty products business of the Metallurgical Products Company will be conducted by Mr. Wilenchik from his company's Philadelphia plant, as in the past.

Business Outlook for Next Year

An optimistic view of prospects for 1950 in the metal trades industries was expressed in the main by 40 business leaders, despite their concern over the current steel and coal strikes.

In a poll at the Golden Anniversary Convention of the National Metal Trades Association in the Palmer House, the majority said they believed business would range from "fair" to "good." Only one thought conditions would be "excellent," while one other was pessimistic enough to report "poor."

However, the vote was almost two to one against production and employment equalling that of 1949.

The business men listed employee and welfare demands as the potentially most troublesome problem for management next year. Threatened strikes and the forthcoming Congressional elections ranked a close second and third, respectively. Individual opinions rated lack of material supplies, waiting attitude on the part of consumers, the Socialistic trend and how to obtain profits from lower business volume with a "high break-even" point as other pressing problems.

The greatest thing the Government could do to assist industrial prosperity next year is reduced spending, the poll revealed. Tax reduction and less Government in business received equal votes as the next steps likely to be helpful. Only two feared an impending World War III.

Individual opinions on what the Government could do to help business included stopping union monopoly and stabilizing policies so business can plan ahead.

All but four reported their businesses were well-geared to meet possible defense production.

A spot check of representative metal users revealed they have enough steel on hand to continue normal production for the next 30 days. Some expressed the belief that users of special steels would find themselves in difficulties much sooner, if the strike continues.

NEW BOOKS

Metal Industry Handbook

Published by The Louis Cassier Co. Ltd., Dorset House, Stamford St., London SE 1, Eng.

A compilation of useful data and tables on metals. The principal sections are 1) General Properties and Mechanical Treatment of Metals and Alloys, 2) General Data and Tables, 3) Electroplating, and 4) Directory Section. The Electroplating section consists of 50 pages, and covers the various bath formulations, cleaning notes, polishing and finishing, and anodizing. Various tables useful to the electroplater are also included.

Chemical Formulary

Published by Chemical Pub. Co., Brookiyn, N. Y. Price $7.00.

Additional formulas have been collected, together with many formulas obtained from the Allied Intelligence Corps from German documents, to make up the eighth edition of this well known book. The directory section on sources of chemicals has also been enlarged. Twenty-two general sections of formulas, from adhesives to textiles treatments, are included. Volume 8 thus serves as a supplement to the previous volumes in the series.

Practical Employer-Employee Relations

Published by the National Metal Trades Assn., 122 S. Michigan Ave., Chicago 3, Ill. Price $1.50.

This booklet summarizes the most modern and successful techniques of conveying information to employes and receiving ideas from them. Covering virtually all phases of good plant and community relations, the manual reviews existing media to accomplish this—from word of mouth to house organs, to motion pictures and "open houses." It was prepared after long study by a special Committee of seven leading industrialists, under the chairmanship of *Walter S. Roach*, vice-president of the Flexible Co., Loudonville, O.

The introduction stresses the need to tell workers the economic facts as they apply to their company, themselves, the community and the nation. "When employes become disillusioned," the introduction states, "and cease to have faith in their employers and the economic system which has enabled them to prosper, they will look elsewhere for guidance. They are likely to be attracted by the false prophets who so glibly promise an easy way to achieve progress and security."

Letters to the Editor

Mr. Walter Raymond
Editor, Metal Finishing
11 W. 42 St., N.Y.C.

Dear Mr. Raymond:

The announcement in the October issue of METAL FINISHING of the gaseous plating system developed by the Commonwealth Eng. Co. was of considerable interest to me, as I have on occasion experimented with carbonyls. Plating out of metals from the gaseous state, as pointed out in the announcement, while not new, merits considerable attention. It is a process that can serve as a valuable adjunct to the electroplating process inasmuch as it offers certain definite advantages over electroplating for special classes of work. Accordingly such a development should be encouraged in every way, as it can be the starting point for a completely new industry that will complement our now rapidly growing electroplating industry.

However, in describing developments of this kind there is a tendency to be a little on the euphemistic side. Rather I should say there is a tendency to gloss over disadvantages in view of the possibly great potential value of the process.

In the case of using the carbonyls there is the serious disadvantage that very large volumes of carbon monoxide, an insiduous and deadly gas, are used and generated by the process. This gas is insiduous because it has no characteristic odor or color, producing a gradual drowsiness and coma, and it is deadly because one part of it in 10,000 parts of air is definitely poisonous. Since, in the machine illustrated, this gas would necessarily be under pressure, every joint and fitting would have to be absolutely leakproof, and it seems to me it would be unwise to stand next to the gas chamber as illustrated unless there was an absolutely foolproof automatic safety alarm that would signal unmistakably the presence of CO in harmful amounts in the vicinity of the machine. . . . There is also a further disadvantage in the fact that carbonyls when mixed with a little air can be highly explosive.

These two major disadvantages are not pointed out to put a "squitch" on such a process because there can be no doubt that careful engineering can overcome them, but to discourage uninformed individuals from "playing" around with such compounds.

The Commonwealth Eng. Co. announcement should encourage research in discovering and utilizing less harmful volatile metal compounds that can be thermally or catalytically decomposed to precipitate the metal on a given surface. Certain such compounds are already known and a search should be made for more of this type.

Sincerely yours,
Joseph B. Kushner.

Dear Editor:

In your "Shop Problems" section of the July (1949) issue you had an article on plating on stainless steel.

At one time I used a solution similar to the one you mention, and was told by one of my friends to use a strike in 50% hydrochloric acid. I tried this and it worked so well that I discarded my old nickel strike, as I got much better results with a lot less trouble. Using a 50% by volume hydrochloric acid strike, with steel anodes for 5-15 seconds, you can then plate stainless steel as easy as any other steel.

Very truly yours,
GEORGE BELL
854 *W.* 42 *St.*
Norfolk, Va.

The Editor—Metal Finishing,
11 West 42nd Street,
New York 18, N. Y., U.S.A.

Dear Editor:

In the October issue we note your recommendations for the preventing of spotting out on brass plated zinc base die casts. We here in England have to electro-plate die castings which at times are very porous even before polishing, and probably worse after they have been polished. This refers, of course, to sand cast aluminum castings which are brass plated or bronzed for decorative finishes. Barrel brass plating we do in fairly large quantities and we experienced similar problems of the spotting out which comes from plating with cyanide solutions.

This we have overcome by treating the castings in the usual way i.e. degrease, acid dip (weak hydrofluoric) and copper plate. If the article be brassed at this stage then spotting out will take place but if it be plated with tin before the brass stage then spotting out is eradicated. The tin plating may

be done with a tin chloride solution which is quick and cheap and the deposit need only be very small but enough to stop staining out.

By this method, however bad the casting may be pitted or open in structure, an excellent result is obtained. Of course, a good copper from a Rochelle solution usually overcomes the trouble but we find the tin method works well. We trust this might be of assistance to your readers who may care to try it out themselves. May we take the opportunity of offering our congratulations to you for a well balanced journal from which we do keep abreast with up to date developments in America but we might add that quite often some of the new developments had already been tried, approved or rejected in England long since—but we expect the same thing can be said about our own progress.

Yours sincerely,
for A.E.R. (1938) *Ltd.*,
C. Hunt, Director.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Testimonial Dinner Given for Art Logozzo

The Hartford Branch were hosts on October 15th for a testimonial dinner and educational meeting in honor of *Art Logozzo*, new Supreme President of the AES, at The City Club in Hartford, Conn. Art is a member of the Hartford branch, and judging from the remarks of the various speakers and from the letters from others who could not attend, he is one of the most popular presidents the Society has ever had. Art's father and one of his brothers were on hand to hear the praise heaped on his curly head by the eloquent Toastmaster, *Mr. Manson Glover*, as well as by *Frank MacStoker*, 3rd V.P. of the Supreme Society, and *Dr. Kenneth Graham*, executive secretary of the Society. The guest of honor was presented with a beautiful leather brief case, and also a lacquer painting made by the oldest member of the Hartford branch, "*Stevie*" *Stephenson*.

Speakers' Table (left to right): Dr. K. A. Graham, Exec. Secy. of the AES; Walter Raymond, Editor of Metal Finishing; William Phillips, Dir. of Electrochemical Research, General Motors Corp.; Arthur Logozzo, new Supreme President of the AES; Frank W. Smith, Pres., Hartford Branch; Manson Glover, Toastmaster; Frank MacStoker, new Third V.-P. of the AES; Mr. Logozzo. Art's father; Frank Clifton, Asst. Dir. of Electrochemical Research, General Motors Corp. In foreground are Emil Beloin, of the W. D. MacDermid Co., and Clarence Rosenbeck, of the Union Hardware Co.

Following an excellent roast beef dinner, guests were treated to a fine talk and demonstration on "Plating in Motion," by *Bill Phillips* and *Frank Clifton*, of the General Motors Research Laboratory. Anyone who has not seen this demonstration of actual

***THE MAN** himself. He looks a little worried—could be either his new responsibilities as Supreme Pres. of the Society or the new addition to his family. In the foreground are Kermit Simons, Dir. of Research, Royal Typewriter Co., and Mr. Plating (George B. Hogaboom).*

plating processes taking place before their eyes on the picture screen, including visual demonstration of such things as the effect of addition agents in lead plating, wetting agents in nickel plating, and the effects of low pH on nickel plating, have missed one of the best educational demonstrations ever

Another view of the opposite end of the speakers' table, showing from right to left Frank Clifton, Mr. Logozzo. Sr., Frank MacStoker, Manson Glover, etc. In the foreground are Leon Pierce, of the Danbury Metal Finishing Co., George Hogaboom, and Howard Hancock, of The Chemical Corp.

presented before a group of electroplaters. Mr. Phillips concluded his talk with some interesting notes on the scope of the plating developments at General Motors. *Mr. George Hogaboom* was in charge of arrangements for the entire affair.

Newark Branch Annual Educational Session and Banquet

The 36th Annual Educational Session and Banquet of the Newark Branch of the A. E. S. will be held at the Robert Treat Hotel, Newark, on Saturday, December 17th. The educational session will get under way at 2 p.m. and will feature the following speakers:

1. J. B. Winters—The R. O. Hull Co., Cleveland, O., "*Factors That Influence the Operation of Chrome Plating Baths.*"
2. Dr. S. Heiman — Philadelphia Rustproof Co., Philadelphia, Pa., "*Deposition of Metals on Aluminum.*"
3. Dr. E. T. Candee—Lea Mfg. Co.,

Waterbury, Conn., "*Metal Finishing Research.*"

The Banquet will start at 7 p.m., with entertainment and dancing until 1 a.m. Tickets for this affair may be obtained from *Mr. George Wagner, 35 Fourth St., Newark, N. J.*, at $6.00 per person.

New York Branch

At the October open meeting of the New York Branch of the A. E. S. a large group turned out to hear a discussion on precious metal plating by two experts, *Dr. K. Schumpelt*, of Baker & Co., and *Mr. Edwin Rinker*, of the Bart-Messing Corp. Mr. Schumpelt discussed rhodium, palladium and platinum, and Mr. Rinker talked about gold plating. High spots of Dr. Schumpelt's discussion were as follows:

When plating rhodium over silver plate or sterling silver, a preliminary coating of nickel should first be applied to prevent the tarnishing of the silver from lifting off the rhodium deposit, which is very porous due to its thinness. He prefers the sulfate rhodium bath because his experience indicates that the phosphoric bath has poorer throwing power, which is an important factor in plating jewelry, and also because the phosphoric bath is not suitable for plating over lead-base alloys. Purification of rhodium baths is very difficult, even the ferrocyanide treatment introducing organic contamination. Reverse current plating is not suitable for platinum or rhodium plating, as there is no dissolving effect on the deposit during the reverse part of the cycle, hence no smoothening or brightening of the deposit. Drag-out rinses after rhodium plating must be acidified prior to use to prevent the rhodium from being precipitated and lost as a sludge. An approximate relative cost for plating equal thicknesses of gold, palladium, platinum, and rhodium is 2-1-2-6 respectively, but because of its dark color palladium is not useful for decorative purposes.

Mr. Rinker gave a practical approach to the problem of producing carat gold shades, and discussed the types of equipment required, including thermostatic control and stepless rectifier controls. He advised making up small baths from a basic yellow gold formula, then adding small known amounts of copper, nickel, or silver salts to obtain the desired color. From this small bath the proper amounts can be calculated to make up larger baths. The basic gold plating formula preferred by Mr. Rinker is one containing ferrocyanide. He also advised using stainless steel anodes only, and never stirring the work pieces during plating. Close chemical control over all constituents is of the utmost importance in producing uniform shades.

As would be expected in a meeting where so many of the members and guests are engaged in the jewelry plating trade, a lively and long discussion period followed each speaker's presentation.

Rochester Branch

The regular monthly meeting of the Rochester Branch A.E.S. was held October 17, 1949, at the Ukrainian-American Club. Seventeen members attended the dinner served in the main dining room of the Club, prior to the business meeting.

The business meeting was called to order by the Pres., *Mr. Joseph Hull*. *John Adams* reported an approximate loss on the annual picnic of about $150.00. A complete report is in the possession of the treasurer. *Ray Berghold* volunteered to head the Christmas Party Committee. This affair is to be held some time in December.

Librarian *John Duford* introduced the speaker for the evening, *Mr. A. S. Kohler*, from the Frederick Gumm Chemical Co. Inc., who spoke on "Barrel Burnishing." Mr. Kohler was well prepared with charts, free hand sketches, and samples to illustrate major points of his talk. An interesting display of sample parts being done locally was prepared by the company's local representative, Ray Berghold. After a

lengthy question and answer period, Mr. Kohler was given a rising vote of thanks for his splendid talk. Attendance was 36 members and 7 guests.

Buffalo Branch

The first meeting of the new season was held by the Buffalo Branch on September 9th at the Markeen Hotel. The evening was highlighted by the presence of *Robert K. Guffie*, of United Chromium, Inc., who spoke on "Plating Room Headaches and Some of Their Cures." Mr. Guffie dug deep into his bag of experience to bring up some plating room stories that were educational as well as entertaining. The high spot of the evening was Mr. Guffie's report on the new self regulating chromium bath recently released by his company. The solution is claimed to have 30% efficiency at the cathode. Mr. Guffie outlined vividly the economies which could be effected by the adoption of this bath. It should be added that Bob brought his own professional heckler along in the person of his brother, *Jim Guffie*, also with United Chromium.

The Cavalcade of Star Speakers was continued at the October 7th meeting at which time *Wesley Cassell* of the Lea Manufacturing Co. presented a paper on "Problems in Plating Room Equipment and Layout." In a frank but affable manner Mr. Cassell described the many evils that are visited upon many plating rooms today because of poor engineering planning. He then proceeded to delineate the criteria to be followed in the selection of plating room equipment covering everything from the smallest pipe fittings to large plating conveyors. Mr. Cassell seemed to have impressed his audience in view of the stimulating question period which followed.

Chicago Branch

Sixty-nine members and guests were present for dinner on October 14, following which the group moved to the auditorium for the regular meeting. Total attendance was 140, with approximately 12 members present from out of town. The *Electro-Chemical Society* was holding its annual Fall meeting in Chicago, which undoubtedly accounted for the large group from out of town.

Dr. Walter Meyer, President of Enthone, Inc., presented a very instructive and timely subject on the preparation of aluminum and aluminum alloys for electroplating. Dr. Meyer's discussion was restricted to zinc immersion treatment only and thoroughly covered the theory and practice in preparing aluminum and its alloys by this method. In addition the speaker briefly described the function of bright dipping aluminum, with several formulas being suggested. While all of the bright dip solutions are excellent cleaners, it was suggested that bright dipping prior to the zinc immersion treatment would be beneficial. A very interesting and active discussion period followed Dr. Meyer's talk.

President Glab announced the appointment of *Mr. Rudy Hazucha* as chairman of the banquet committee, and also announced the appointment of *Mr. Bill Sticksel* as sergeant at arms.

Los Angeles Branch

Dr. E. K. Graham, executive secretary of the American Electroplaters' Society, was the guest of honor and principal speaker at the November 9 meeting of Los Angeles Branch.

Dr. Graham's arrival in Los Angeles on a West Coast tour of A.E.S. Branches was on a saddened note when he was advised that Ernest Lamoureaux, a long-time friend and A.E.S. associate, had died a few hours previous to his reaching Los Angeles.

On the night of November 8 Dr. Graham met with the officers and board of managers and convention committee of Los Angeles Branch, at which he was able to offer much valuable assistance and sound advice to the local committee on its preparations for the 1951 A.E.S. convention in Los Angeles.

In honor of the presence of the supreme society secretary, the Branch produced an attendance approximating 100 at Scully's Cafe for the meeting on November 9, for the branch considered itself fortunate in having secured as speaker for that meeting not only one of the most prominent national officers but also one of the country's leading authorities on electrodeposition. Dr. Graham's reputation as an authority on that subject, particularly on zinc alloy plating, is well earned, in the opinion of Los Angeles Branch members, who detained him with questions for nearly 1½ hours after the completion of his talk on that subject.

Dr. Graham's talk was presented in two parts. Initially he offered some preliminary remarks on zinc alloy plating in general, following this with a series of illuminated slides which he individually explained and commented upon. Of high interest were the slides which showed some of the difficulties encountered in brass plating, why the troubles develop, and how they can be handled effectively. Slide subjects upon which Dr. Graham offered explanatory commentary of from five to ten minutes each were:

Buffer data on copper cyanide baths and NAOH concentration; zinc cyanide bath compositions; buffer data on zinc cyanide baths; comparative buffer data on copper, brass and zinc cyanide baths; copper-zinc alloy plating baths; variations of ammonia concentrations of copper-zinc alloy baths, etc.

The branch established what it believes to be two national A.E.S. records during the initiation of nine new members, and took particular satisfaction in doing so in the presence of the executive secretary. For the first time (until proven to the contrary) there occurred the joint initiation into membership of a man and his wife—*Russel C. Hedeen*, head of the R. C. H. Supply Co., and *Mrs. Gladys Hedeen*. Among the night's initiates was also *Miss H. Gage Carlson*, giving Los Angeles a total of three feminine members—some kind of a record, too, President *Allen Sulzinger* commented.

The other new members initiated were: *Ralph V. Esten*, Harshaw Chemical Co.; *Harold C. Wells*, A. J. Lynch Co.; *Sherman A. Meade*, Naval Ordnance Testing Station, Inyokern, Calif.; *John F. Brossart*, Industrial Filter & Pump Co.; *William F. Stokes*, Hydro-Air, Inc.; *Edgar Delamatee*, Sundmark Supply Co.

Marcus Rynkofs reported the sudden passing of Ernest Lamoureux on the night of November 7 and read a tribute to the man who had been one of the two A.E.S. honorary life members affiliated with Los Angeles Branch.

Chicago Branch Annual Banquet and Educational Session

The annual banquet of the Chicago Branch will be held on January 14,

1950, at the Stevens Hotel in Chicago. The chairman of the banquet committee, *Mr. Rudy Hazucha*, and his committee have promised that this will be one of the finest annual banquets of the Chicago Branch.

Dr. Monaweck, Branch Librarian, has arranged for an excellent educational session, which will start at 2:00 P.M. The speakers and their subjects are as follows:

Dr. William Blum, "New Direction in Research."

Dr. R. O. Hull, "Factors Affecting Throwing Power."

Dr. B. B. Knapp, "New Developments in Nickel Plating."

The banquet, which is to be held in the main ball room of the Stevens Hotel, will start at 7:00 P.M. The price of the tickets is $7.50 each. All members and friends of the Chicago Branch are invited to attend the annual banquet. It is suggested that reservations for tickets be made as soon as possible, as the number of tickets available will be limited.

On November 11th, 42 members and guests were present for dinner, following which the group moved to the auditorium for the regular monthly meeting. The total attendance was 100. As an added attraction movies were shown of highlights of the 1948 World Series, through the courtesy of *Mr. Harry Hansen* of the Electro-Chemical Division of E. I. DuPont de Nemours & Company.

Mr. Ben Martin of the McGean Chemical Co., presented a very interesting talk on high speed bright nickel plating with the McGean bright nickel solution. Laboratory data showing the effect of variation in concentrations of metal, nickel chloride and boric acid was discussed, as well as the effect of variation of temperature and pH of the solution. A very active discussion period followed Mr. Martin's talk.

The following were elected to membership in the American Electroplaters' Society at this meeting: Burdette Fisher, George Duncan, and William Barron.

Measuring Thickness of Anodized Coatings

Committee B-7 on Light Metals and Alloys recently presented a Tentative Method of Measuring Thickness of Anodic Coatings on Aluminum by Means of the Filmeter. This will be designated B 244—49 T. Several years ago, an instrument called a filmeter was introduced commercially. It is suitable for measuring, non-destructively, nonmetallic coatings on aluminum. Subcommittee VI of Committee B-7 experimented with the instrument as a means of determining the thickness of oxide coatings on aluminum and concluded that the instrument was useful if properly used. The new tentative method is an effort to promote standardized procedures for using the filmeter.

NATIONAL METAL TRADES ASSOCIATION

Election of Officers

The top three executives of the National Metal Trades Association were re-elected to succeed themselves for a second term in 1950 at the concluding session of the NMTA's golden anniversary convention in the Palmer House, Chicago, recently.

Renamed were *Thomas J. Morton*,

Jr. head of the Hoosier Cardinal Corp., Evansville, Ind., president; *Joseph L. Kopf*, president of Jabez Burns and Sons, Inc., New York, first vice-president, and *Philip M. Morgan*, president of the Morgan Construction Co., Worcester, Mass., second vice president and treasurer.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS

The Sixth Annual Conference of the National Association of Corrosion Engineers will be held in St. Louis, Missouri, April 4-7, 1950, inclusive.

Symposia under consideration for the conference include: Round table discussions on general corrosion problems and pipe line corrosion, refrigeration and air conditioning and food industry.

Electrochemical Society of Japan

At the fall meeting of the Electrochemical Society of Japan, held on November 7-9 at the Hall of Science Museum of Tokyo, these papers relating to metal finishing were presented:

1. Studies on the Distribution of Electric Flowlines in the Electrolysis of Aqueous Solutions, by late *C. Fujioka* and *R. Murakawa*.
2. Studies on the Electrodeposition of Chromium from Chromic Sulfate Solution, Effects of Buffer-Agents, by *T. Yoshida*.
3. Contribution to Nickel-Plating—Studies on High-Speed Bright Plating, by *T. Yoshida* and *K. Hara*.
4. Studies on Electrodeposition, Bright - Smooth Deposition of Nickel, by *S. Tajima* and *T. Mori*.
5. Studies on Addition-Agents in Electropolishing Baths, by *I. Miyoshi*.
6. Studies on Electrolytic Etching, by *I. Miyoshi*.
7. Electrolytic Conditions of Large-Scale Electropolishing Operations in Table-Ware, Measure and Shipbuilding Industries, by *S. Tajima*.

Manufacturers' Literature

Straight-Line Automatic Polishing and Buffing Machines

Acme Mfg. Co., Dept. MF, 1645 Howard St., Detroit 16, Mich.

The above company has just issued a new bulletin describing their line of straight-line automatic machines for high-production buffing and polishing. Included are straight-line reciprocating types for bars, tubes, etc.; return types; loose-fixture straightlines; over and under types, and many special models. Copies of the bulletin are available on request to the above address.

Soak Cleaner

The Diversey Corporation, Dept. MF, 53 West Jackson Blvd., Chicago 4, Ill.

The Metal Industries Department of this firm has issued a novel four-page file-size folder on Diversey No. 909, their heavy-duty soak tank metal cleaner.

The folder enumerates features of the cleaner, applications and directions

for its use. The back page offers complete, convincing testimonials of users. The folder will serve as a handy reference to metal working technicians and engineers concerned with particular problems of metal cleaning covered.

Liquid Buffing Compound

J. C. Miller Co., Dept. MF, 55 Mt. Vernon Ave., Grand Rapids, Mich.

The above firm has recently published a bulletin on their new Liquimatic liquid abrasive buffing compound which gives the chemical and physical properties of the compound together with recommendations for its various applications. Auxiliary equipment required for converting to liquid abrasive buffing is also pictured. Copies of this bulletin are available on request.

Centrifugal Pump Installation and Operating Manual

The Duriron Co., Dept. MF, Dayton 1, Ohio.

A revised instruction booklet on the installation and operation of centrifugal pumps in corrosive service has been issued by above firm. While dealing specifically with Durcopumps, the information in the twelve varnished smudge proof pages is applicable to all centrifugal pumps. The booklet deals with the proper location of pumps; proper foundations for pumps; correct alignment; priming standard pumps; proper piping arrangements; adjustment of impellers; common troubles and how to overcome them; friction data, formulae for figuring capacity, head and horsepower, and conversion data.

Self Contained Dust Collectors

Aget-Detroit Co., Dept. MF, 624 First National Bldg., Ann Arbor, Mich.

A new 36 page catalog and price list of unit type Dustkop dust collectors contains specifications and infromation on entirely new models, improved models and illustrations of applications of Dustkops on grinding, buffing, polishing, sanding and other dust creating operations. A separate section is devoted to vapor collectors which are used to collect mist and vapor from thread grinding, screw machining and centerless grinding, etc.

Of special interest to the plant engineer is an analysis of heat and power savings claimed possible through the use of unit-type rather than conventional centralized dust control systems. Actual case histories with dollars and cents savings, along with drawings of the arrangement of the dust sources are given.

A "dual" index that really works, allows the reader not only to find collectors according to capacity in cfm but also gives page numbers according to specific types of dust problems.

Catalog is available without obligation.

Metallizing Worn Packing Areas

Metallizing Engineering Co., Inc., Dept. MF, 38-14 30th Street, Long Island City 1, N. Y.

The September issue of the Metco News reports that users of metallizing are saving time and money on rebuilding worn packing areas. For instance, a steel mill had two 5000 H.P. compressors which are used alternately 24 hours a day, 7 days a week. Due

to slight throttle leakage, the stand by unit accumulates moisture at the packing section which corrodes the mild steel shaft. The corrosive action finally causes them to seize. On one occasion, the rings revolved with the shaft until they were destroyed. Then they decided to try metallizing. Only 11 pounds of high carbon stainless steel were used on each shaft, and the total machinist's time for one man was only three 8-hour days. After one year and eight months, the shafts "looked as though they had never been used."

Another user tells of the metallizing jobs they do on heavy duty press rams. Typical of these is a 7550 lb. ram from a 1500 ton forging press. These iron rams quickly become scored due to their severe service conditions under intense heat and high load stresses, resulting in rapid wear of expensive packing. The rams are now metallized with stainless steel which greatly increases their service life. This user saves over $800 on each repair job, over the cost of a new cast iron ram.

Another typical metallizing application is the rebuilding of worn pump sleeves. A Canadian paper mill doubled the life of their pump sleeves—and saved $900 in labor cost alone.

Write for your copy of the Metco News—Volume 4—No. 10.

Standard and High-Voltage Selenium Rectifiers

Westinghouse Electric Corp., Dept. MF, P. O. Box 868, Pittsburgh 30, Pa.

A new booklet tells the story of Westinghouse standard and high-voltage selenium rectifiers for power supplies and electronic circuits.

Efficiency curves for both the standard (type M) and high-voltage (type H cells) are included, together with discussions entitled "Efficiency — Aging—Life," "Back Leakage—Reverse Resistance," "Forward Resistance." Life characteristics of types H and M cells, for various overload conditions or high ambient temperatures, are plotted graphically.

The booklet concludes with a tabular presentation of schematic diagrams, formulas for calculating rectifier performance, and cell ratings for a wide range of applications.

Synthetic Detergents

General Aniline & Film Corp., Dept. MF, 444 Madison Ave., New York 22, N. Y.

"Synthetic Detergents—Their History and Applications" is the title of a new descriptive folder just issued by this firm.

Written in non-technical language, the folder is designed to acquaint laymen buyers of detergents with simple facts about these materials which are usually explained in heavy scientific terms.

The folder defines both detergents and synthetic detergents and explains the need for the latter in industry, home, textile field, cosmetics, insect and weed killers, institutional cleaning, community life and in thousands of other places where their outstanding properties help make better products at a lower cost.

The three general types of synthetic

detergents—anionic, cationic and nonionic—are explained, along with the advantages of each type.

An easy-to-use chart gives the name, type, family and uses of 19 Surface Active Agents known as the Antarox, Antaron and Antarane families.

Copies of the folder may be had by writing the company at the above address.

Corrosion Service Piping

Taylor Forge & Pipe Works, Dept. MF, P.O. Box 485, *Chicago* 90, *Ill.*

Bulletin 485 is a comprehensive treatment on stainless steel and nickel alloy anti-corrosion and anti-contamination piping. Economics, standards, advantages of welding, extensive technical data, design tips, and complete dimensional information on stainless fittings and flanges are included in the 32 page, profusely illustrated bulletin.

The Bulletin is particularly interesting and valuable at this time, as the American Standard for Stainless Steel Pipe, ASA B36.19-49, has just been adopted by the American Standards Association. Bulletin 485 was prepared with B36.19 as its basis and it contains a comprehensive discussion and explanation of the importance of this standard.

Metal Cleaning and Treating

Klem Chemicals, Inc., Dept. MF, 4393 *Lanson, Dearborn, Mich.*

A set of convenient reference file folders of interest to those engaged in metals cleaning and other users of industrial chemicals is announced by this firm. Attractively printed in two colors on durable stock, the folders facilitate filing of technical information under four general headings: Paint Removal, Phosphate Coatings, Metal Cleaning and Spray Booth Maintenance. The cover of each folder provides brief descriptions of the complete line of various compounds and chemicals available from the company along with the free technical advisory service furnished by Klem Chemicals service engineers.

News from California

Stuart Krentel, west coast manager for MacDermid Co., attended a three-day conference of company executives and sales personnel at headquarters in Waterbury, Conn., in mid-October. He purchased a new Buick in Chicago and drove the western portion of the trip back to Los Angeles.

Morton Schwartz, of the Morey Electro-Plating Corp., Lynwood, Calif., attended the recent convention of the Electrochemical Society in Chicago, making the 1½ weeks trip by automobile.

Russel C. Hedeen, who formerly operated as the Hedeen Co., with headquarters in San Francisco, has centered his plating supply business in Southern California under the name of *R. C. H. Supply Co.*, with offices and warehouses at 7108 *Santa Fe Avenue, Huntington Park.* The firm now serves as West Coast branch for Divine Brothers Co., Inc., and also represents such well-known manufacturers of plating shop products as Nu-Matic Grinders, Inc., Ryman Engineering Co., Newton Manufacturing Co., and the Gripmaster Div. of Nelson Chemical Co.

American Metal Products Corp. has construction underway on a 5400 square foot addition to its plant at 2911 Compton Ave., Los Angeles, for

increased production of metal heating and plumbing supplies.

Acme Door Corp. and Central Sheet Metal & Roofing Co. of Oakland, Calif. have merged into the *Acme Central Metals Products, Inc.*, and have established a plant at 3247 *Ettie Street, Oakland*, for the manufacture of rolling doors and various types of metal-covered doors.

Mutual Enameling & Rustproofing Co., Los Angeles, announces the appointment of *William H. Harrison* as general manager. Harrison assumed the West Coast post after some 20 years activity with various metal finishing firms in the Detroit, Mich., area.

General Electric Co. announces the appointment of *Arthur D. Bragg* as district manager of its apparatus division. succeeding Allen G. Jones, who recently retired. Mr. Bragg has been with the General Electric Co. for the past 24 years, serving in both the Los Angeles and San Francisco offices. Until his recent promotion he was assistant Pacific District manager of the apparatus division.

Charles A. Dostal, vice-president and Pacific Coast district manager of the Westinghouse Electric Co., has retired after 43 years service with the firm. His duties have been assumed by *Walter J. Maythem, Jr.*, former manager of industrial sales in the firm's Chicago division.

Obituaries

ERNEST LAMOUREUX

Mr. Ernest Lamoureux, 79, honorary life member of the American Electro-Platers Society, died of a heart attack at Los Angeles on November 7. Death

came to "Ernie," as he was affectionately known throughout the nation's plating industry, while he was playing bridge at the home of his brother, Alphonse, in Los Angeles.

In addition to Alphonse, he is survived by another brother, Remi Lamoureux of Piqua, O., and two sisters, Mrs. Rose Esary of Indianapolis, Ind., and Mrs. Alice Dilworth, of Piqua. Since the death of Mrs. Lamoureux in December, 1941, Ernie had lived alone at 1207 S. Reno Street, Los Angeles.

The body lay in state at the Brown Mortuary in Los Angeles where it was viewed by hundreds of members of the plating and allied industries. Funeral services were held at the Church of the Precious Blood on November 12, with interment following in Calvary Cemetery, Los Angeles. Six long-time members of Los Angeles Branch of the American Electroplaters' Society, in which group Mr. Lamoureux was active, served as pallbearers.

Among those who paid tribute to Ernie was Dr. A. K. Graham, executive secretary of the A.E.S., who arrived in Los Angeles one day after Mr. Lamoureux passed away.

Mr. Lamoureux was born in Saint

Angel, Quebec, 15 miles from Montreal, in 1870. From 1879, when the family moved to Cincinnati, O., he was associated with the plating industry for 50 years, until his retirement in 1929. He started as a nine-year-old in the plant of the W. C. Davis Stove Co. in Cincinnati, wiring work before and after plating, for in those days there were no racks. From 1879 until 1906 he was active in the shop end of the business with such firms as Miller Plating Works, Cincinnati, supervisor of plating for Sidney Hardware Co., Sidney, O., Columbus Bicycle Co., Columbus, O., Phoenix Bicycle Co., Freeport, Ill., and Dayton Fan & Motor Co., Dayton, Ohio.

In 1906, with 27 years of practical shop experience behind him, Mr. Lamoureux began a 23 year tenure in the sales end of the industry. That year he joined the sales staff of Zucker-Levett & Loeb Co. of New York, covering portions of Pennsylvania, Ohio and Indiana. Following liquidation of the firm in 1908, Mr. Lamoureux served as a freelance sales representative until 1911, and then joined the sales staff of the newly established Munning-Loeb Co. He served until 1929 with that firm, which ultimately through changes of name and mergers became the Hanson-Van Winkle-Munning Co. of today. When he retired in 1929 he was mid-west manager for H-VW-M, with headquarters in Chicago. For some years after his retirement Mr. Lamoureux lived in Piqua, O., moving to Los Angeles in 1936.

Mr. Lamoureux has left a heritage of notable accomplishments, both in the industry which he served for half a century and the association with which his greatest interests lay, the A.E.S. He became a member of the original foundation branch of the A.E.S. at its second meeting. He was associated with the group which formed the Chicago branch. He assisted in the formation of the Milwaukee Branch and was one of the leading spirits in organizing branches in St. Louis, Mo., Dayton, O., and Grand Rapids, Mich. He served with distinction as the beloved elder statesman of Los Angeles branch from the mid-1930's until his death, for many years acting as chairman of the Board of Managers of that branch.

Mr. Lamoureux, with the late H. W. Wilmore and Oscar E. Servis, wrote the original constitution of the Supreme Society. He was the originator of the A.E.S.'s Plan of Prize Awards for the best and most valuable paper each year. He also originated the idea for exhibits by platers at annual conventions. He was privileged to make the presentation of the first such awards at the Montreal convention. He was also associate editor of the *Monthly Review* in 1914.

His record of achievement in the technical side of the industry is equally imposing. He was the first to advocate the commercial use of high purity anodes and single salt solutions.

In recognition of his outstanding achievements in behalf of the industry and the Society, he was awarded in 1941 a distinction which he cherished more highly than any other honor that came to him—election to Honorary Life Membership in the American Electro-Platers' Society.

ALBERT J. LAFORET

Mr. Albert J. Laforet, 55, salesman for Buckingham Products Company, Detroit, died suddenly on October 17th at Washington, D. C. while on vacation. Mr. Laforet had been with the Buckingham Company for more than 12 years, covering the Michigan territory. He leaves a widow and two sons, Albert Jr. and Henry.

INDEX TO VOLUME 47—METAL FINISHING

JANUARY-DECEMBER, 1949

(Compiled by W. A. Raymond, Eng. Editor and I. Oquendo, Edit. Ass't.)

In this index all material that appeared in the January through December issues of *Metal Finishing* is listed according to subject matter, with cross references where required. Following each listing will be found a letter indicating the manner in which the material was published, as follows:

(S)—Shop Problem
(R)—Recent Development
(P)—Patent
(M)—Manufacturers Literature
(B)—New Book
(D)—Engineering Data Sheet
(L)—Letters to the Editor

Any reference not followed by a letter was a feature article. The numbers in the right-hand column refer to the month and page numbers; **6**-85 means June issue, page 85, etc.

CHROMATE SURFACE TREATMENTS

CHROMIUM PLATING

CLEANING

COLORED SURFACE TREATMENTS

COLOR BUFFING—See Polishing

CONTINUOUS PLATING OF WIRE AND STRIP

COPPER PLATING

CORROSION RESISTANCE

COSTS

DEGREASING

DESCALING—See Pickling.

DIE CASTINGS

WETTING AGENTS

ZINC PLATING

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DEC 12 1949

DECEMBER, 1949

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS
FOUNDED 1903

Read & Pass On

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Holiday Greetings

AS Christmas and New Year again approaches, we think of the grand spirit that prevails. It would indeed be wonderful if this spirit continued on throughout the year. Thus, the millennium would be attained, *peace on earth and good-will toward man* established.

— ★ —

Frederick Gumm Chemical Company and its employees wish our many friends in the Industry a joyous and happy *Christmas* and *New Year.*

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N.J.